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Health Hazards from Specific Poisons in Industry

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THE industrial hazards of the worker may be roughly divided into the following five classes:

(1) The danger of contracting a communicable disease as a result of occupation or association with fellow workmen.
(2) Working in atmospheric conditions which are not conducive to proper heat loss from the body.
(3) Contact with materials that are not systemically poisonous but cause local irritation.
(4) Accidents.
(5) The handling and subsequent breathing, swallowing or absorbing through the skin of specific poisons.

Communicable Diseases

The danger of contracting a communicable disease from fellow workmen is a hazard not to be dismissed without comment. A perusal of mortality records shows tuberculosis as one of the most important causes of adult mortality. In early adult life as high as one death out of four may be due to this disease. Thus the worker in the course of his daily toil may be infected from one of his fellow workmen suffering from it. Industrial work involves close contact. There are certain trades in which the incidence of tuberculosis is very much higher than in the general population. These trades may be divided into two classes: (1) sedentary occupations which attract the type of worker prone to develop or already suffering from tuberculosis and (2) trades in which there is some specific hazard favouring the development of this disease. The garment trade is an example of the first class, and granite cutting of the second class. Therefore, when in a given trade the mortality rate from tuberculosis is high and the nature of the work is heavy, one can assume with some degree of assurance that a definite hazard favouring tuberculosis exists.

Unsatisfactory Atmospheric Conditions

Man, like a machine, uses fuel in the form of food and produces energy. The body, however, is not 100 per cent thermally efficient, but must lose heat in order to produce work. Conditions that interfere with heat losses from the body decrease the worker's efficiency greatly and in extreme conditions may affect his health. The more strenuous the work, the cooler the workroom

should be. People engaged in sedentary occupations should not work in the same air conditions as men engaged in hard physical labour. High temperatures may be compensated for by increasing the air movement. High humidity reduces the range of temperature in which efficiency and comfort are attained. Working in hot conditions is associated with a general increase in sickness. Working in hot, wet conditions increases the incidence of pneumonia and rheumatism. When these conditions are associated with sudden changes to low temperature the hazard is further increased. Men working at hot trades should be provided with proper washroom and locker facilities so that dry clothing can be readily put on before leaving. This is especially important in cold weather.

Effect of Certain Irritants

Considerable discomfort, without any serious consequences, is occasioned by many substances handled in industry. In this class come most of the trade dermatoses such as nickel itch, chrome rash, rubber itch and low grade skin infections like those caused by infected cutting oil. Some cases of skin trouble are entirely due to contact with irritating materials. In others the real cause is a hypersensitive condition of the individual's skin to the material or materials used; this condition may arise after years of exposure and may make it necessary for the sufferer to change his occupation. Few people realize the part played by atmospheric conditions in creating and continuing skin irritation. A hot environment increases skin temperature, which in turn increases skin irritability. Profuse sweating irritates the skin and makes it more alkaline. Alkaline materials remove much of the protective fatty substances of the skin and greatly reduce its natural protection. Many cases of dermatitis are made worse by the use of abrasive hand cleansers and strong alkaline soaps.

Accidents

Industrial accidents cause much suffering and great financial loss, and hardship to the workers. During 1930, according to the reports of the Workmen's Compensation Board of Ontario, 1,265 out of every 10,000 full year workers in that province were injured. The causes of industrial accidents might be tabulated as primary and secondary, the primary cause being the physical agency directly responsible for the injury, while the secondary cause runs the gamut from individual ill-being to advanced psychosis. Perhaps there impinges the factor of individual susceptibility, for we are reliably informed that 70 per cent of the accidents occur in 25 per cent of a given group of workers.

For present purposes, accidents may be divided roughly into three classes: (*a*) purely fortuitous or accidental in the popular sense; (*b*) from exogenous instrumentalities of a human nature; (*c*) from endogenous causes such as speed of movement, keenness of perception, muscular co-ordination, mental adaptation, general intelligence and physical well-being. Evaluation of control of industrial accidents must take cognizance of the personal factor. This has not been generally recognized. Its immediate application lies in the provision whereby workmen sustaining two, or at the most three, even minor accidents in a unit of time, should be removed to a less hazardous occupation.

SPECIFIC POISONS

It is the fifth class of hazard I wish to discuss in greater detail; namely, the hazard associated with the use of specific poisons in industry. Wherever these substances are used, it is necessary to come to some definite conclusions as to whether their use is attended by serious consequences to the workmen. In all

cases a primary evaluation is made, when it should be decided whether or not analyses of materials, dust counts, complete medical examinations are necessary. This first evaluation acts as a kind of clearing house and is consequently very important.

THE FIRST INSPECTION OF THE PLANT

The Company's Attitude

On inspecting a plant, the first person met is usually the manager or superintendent. At this meeting the company's attitude towards the health of its employees is ascertained. Frequently the blame for any occupational disease is placed on the shoulders of the worker. You are told over and over again that the men do not wash, that they stay up late at night, drink or have some other bad habit to which their ailment can be attributed. Remarks of this kind from the man in charge makes one suspicious that trouble has been experienced in the plant and that no action has been taken to find the cause.

It is of importance to know that most industrial diseases are produced by the introduction into the body over a long period of time of relatively small quantities of toxic materials. Hence their onset is usually slow and insidious, and not spectacular like "poisoning" in the popular sense of the word. Some people are much more prone to be affected than others by the same exposure, but unfortunately there is no way to anticipate individual susceptibility. Thus it is not reasonable to conclude, because all the workmen exposed are not affected in the same way and some not at all, that those complaining are not suffering from an occupational disease. In some plants where a definite hazard exists one is told that they have been operating ten or fifteen years without trouble. This may be possible, because, very often, occupational diseases have not been and are not recognized as such, or labour turn-over is so high as to prevent sufficient exposure. This argument in some cases is used to discourage further investigation. It is hard to believe that any manager or superintendent with several years' experience handling poisonous materials would never have seen a case of poisoning. Some few employers even deny the existence of industrial diseases.

The Workmen

From conversation with the workmen much valuable information is obtained. A fairly accurate knowledge of the labour turn-over in the plant can be obtained and whether this measure is being used to prevent the occurrence of occupational diseases. A rough idea of the time lost and the most prevalent causes of sickness are also determined. If a worker complains of ill health, detailed questioning regarding his trouble is of great value. By this means one can usually decide whether the trouble may be due to his occupation or to other causes. Very often the worker will blame his occupation for his ill health when it is due to other causes. This tendency to attribute ill health to causes beyond one's control is not common to the workingman only, but pervades all groups in the community. The general appearance of workmen

is worth noting. Do they look undernourished as a class? Do they appear pale and anaemic? Generally speaking, the older the worker the better he is able to withstand industrial poisons. Females are more susceptible to serious damage than males. If the nature of the work is heavy, one has to bear in mind that more air will be breathed than at a sedentary job. This is very important if a dust or fume hazard exists, as the injurious materials entering the body will be greatly increased in amount.

Are Poisonous Materials Used?

It is not generally appreciated that a great many industrial plants, both large and small, do not know the chemical nature of the materials in use. This statement appears startling, but on further consideration it can be understood, as industry is largely concerned with performance rather than with chemical composition. A large firm may decide to start doing its own paint spraying. A spray booth is obtained and the necessary selection of paints and lacquers is made. In this selection the colour, viscosity, drying time, durability of finish and cost will be considered, while no reference is made to the chemicals used in the finish. If it is a paint it may contain lead or silica; if it is a lacquer it may contain benzol, lead or some other injurious ingredient. The first intimation this type of a plant usually gets concerning the chemical composition of its paint or lacquer is when some workman becomes sick, or an inquisitive factory inspector has asked questions concerning the materials used. Even in plants with laboratory facilities the chemical knowledge of materials is largely confined to the laboratory. Another source of hazard in industries using paints and lacquers is the substitution of "just as good" an article. Very often as far as performance goes this substitute is just as good as the original, but its cost is reduced by using a cheaper substance, cheaper partly because it is poisonous. It is familiar to everyone that a great deal of material is bought under trade name, a name that very often in no way indicates the composition. Seldom are these preparations labelled as to poisonous contents.

Not long ago I visited seventeen plants in which was suspected the use of a volatile poison. All these plants were making the same product. Only three of them had any knowledge whether they were using, might use, or had used this poisonous material. From these plants alone I could have collected enough samples to keep a chemist busy for a year. Fortunately, however, from close attention to the particular process, verbal examination of the workers and the information gained from the three plants knowing what they were doing coupled with analyses of a limited number of samples, I was in a position to estimate the hazard for the whole group. Most of the spectacular and serious occupational cases occur in plants where the workmen and executives alike are ignorant of the poisonous nature of the materials used.

Nature of Process

If poisonous materials are used, the type and nature of process greatly influence the danger. Ordinarily processes may be divided into open, closed or partially closed. The ideal method of handling poisonous materials is to use a closed

process, but this is not always practicable. Even with a closed process a degree of hazard exists when the materials are put in and taken out, and when the process machinery is cleaned. This cleaning may be very hazardous. Entry into an enclosed space of any kind is not without considerable danger unless proper precautions are taken. In open or partially closed processes there is always some hazard when poisonous materials are used. This hazard can be greatly reduced, but never entirely eliminated, by the use of efficient exhaust systems. The nature of the process is also of importance. Although wet processes naturally do not produce as much dust as dry ones, the advantage may be lost by the unfavourable influence of dampness on the incidence of tuberculosis, pneumonia and rheumatism. Dry grinding and mixing may be the cause of considerable dust, and hand sorting of scrap lead is usually very hazardous. The use of pneumatic tools is very often accompanied by the production of large amounts of fine dust effectively scattered about by the air exhaust on the tool.

The *inhalation* of poisonous dusts or fumes is the most common cause of industrial poisoning. From this it can be readily understood that the control or prevention of industrial diseases depends primarily upon the employer, rather than upon the personal hygiene of the worker. Dust and fumes are produced by processes, not by workmen.

Silica and Lead Dusts

While all dusts may be more or less injurious, the chief offenders are silica and lead. In the case of silica dust it is the particles under ten microns in size that cause the trouble, entrance being gained through the respiratory tract. In lead much of the coarse dust is swallowed and absorbed by the intestinal tract, the fine dust entering the body by way of the lungs. It is reasonable to assume that if visible dust is present, fine dust is present also. But if no dust is visible this does not mean that no fine dust is present in the air.Generally speaking, it is dust of a size seen in a beam of sunlight which is most important. Control of visible dust is not difficult. Control of invisible dust is extremely difficult, if not impossible in some cases, because it must be recognized that in addition to dust of visible size and even of ultra microscopic size there are dust particles so infinitesimal as to be incapable of human measurement or comprehension. Even the grinder working at a slowly revolving natural grindstone kept continuously wet with a stream of water produces enough dust to cause trouble after many years of exposure.

A common way to ascertain the presence of invisible dust in a process is to take dust accumulations from rafters, sills, etc., near the process. If this contains the poisonous materials used in the factory it is reasonable to assume a hazard. In making a survey in a lead plant recently, samples of a fine dust were obtained from the locker tops in the washroom. This washroom was in a building by itself located several hundred feet from the workshop. The dust on analysis contained 12 per cent lead. Here was a lead hazard in a place where no lead was thought to be present. It is essential that people using poisonous materials keep their places clean. Housecleaning is usually

the first step taken in making a plant safe. Expensive exhaust systems are of relatively little value if fine dust is permitted to remain on places of lodgement. The constant vibration of machinery and the movement of materials on the floors will continuously stir up this dust, creating a maximum hazard from a minimum amount of dust. It is the size of the particle, rather than the weight, that determines the rate of settling of fine dust. The smaller the particle the bigger is its surface in relation to its mass. The use of machinery has greatly increased the dust hazard, especially in trades like granite cutting, where pneumatic tools have displaced the hand hammer. The means of keeping dust down by mechanical methods have not kept pace with its production by machines.

Poisonous Fumes

Next to dust as a cause of industrial diseases come poisonous fumes. Fumes or vapours are very readily absorbed through the respiratory tract. This can be understood, as the lungs are highly specialized organs for the exchange of gases to or from the body. Lead, benzol, and nitrous fumes are commonly encountered in industry. Lead fumes are given off by molten lead at a high temperature. The control of the temperature of the lead will control the fume hazard to a great extent, but will not prevent the dust hazard produced by the formation of lead oxide on the top of the molten metal. Nitrous fumes are relatively insoluble in water and, compared with many others, are less irritating. They reach the alveoli with little warning and there produce an intense inflammation leading to pulmonary cedema and usually death. The first sign of any trouble comes from twelve to forty-eight hours after exposure to the fumes. On account of this delay the real cause of the trouble is often obscured and, indeed, seldom recognized, so that very few cases of poisoning by nitrous fumes are brought to our attention. Gases like chlorine and sulphur dioxide, while very poisonous, are so irritating that they are practically irrespirable in toxic concentrations. Hydrogen sulphide, the aroma of which pervades most chemical laboratories, is about as toxic as hydrocyanic acid gas and can be evolved from many organic materials. This gas is the common cause of fatal poisoning in sewers and sewage disposal plants.

High concentrations of benzol vapour, like high concentrations of the vapour of toluol, gasoline, ether, chloroform and many other solvents when breathed, cause anesthesia and even death. But the concentration required to produce this sudden effect is not ordinarily encountered in industry, and when encountered the nature of the happening is more like an accident than an occupational disease. It is continued exposure to small amounts which constitutes the major industrial hazard. Men daily exposed to a concentration as low as 100 parts of benzol vapour per million parts of air are very likely to show some blood changes. Most of the cases of benzol poisoning coming to our attention, however, have been caused by concentrations in excess of this amount. In one case where the exposure was very small it took ten years to produce fatal results. In evaluating a benzol hazard one must bear in mind that it is the continued use of benzol, even in small amounts, that is likely to

cause serious trouble, and not the occasional use of larger amounts. Thus a painter who uses paint remover, which usually contains benzol, does not get into trouble if his exposure is limited to this source. In factories, however, it is very difficult in some cases to draw the line between continued and occasional use.

From these remarks I do not wish to leave the impression that the use of poisonous materials in industry is bound to produce dire results, for this need not be the case. There are a great many plants in Ontario where poisonous materials are used without any known serious consequences, but these plants realize what they are using and adopt adequate methods of control. The most serious and spectacular cases of occupational diseases usually occur in plants where poisonous substances are used unknowingly.

After some spectacular case of poisoning has occurred, many people would unthinkingly advocate the prohibition of the specific or all poisonous materials in industry. This stand, however, seems unreasonable. The use of poisonous substances even under good conditions does constitute some hazard, but their use in industry under reasonable methods of control is not associated with serious consequences. It is unfortunate but nevertheless true that some of the most indispensable materials used in our factories have harmful potenialities and it would be just as unreasonable to prohibit their use as it would be to close all industries because of industrial accidents or to stop the use of the automobile because of the danger inherent in its use.

Erratum

The second paragraph of the editorial, *The Menace of Smallpox*, on page 142 of the March issue should have read as follows:

"The outbreak of virulent smallpox in Vancouver, as recorded by Dr. J. W. McIntosh, brings to mind other epidemics of this disease in Canada. The disastrous Montreal epidemic of 1885, in which 3,164 deaths occurred within the space of a few months, made smallpox history and was so impressive that vaccination in Quebec is still much more complete than elsewhere in Canada, with the exception of New Brunswick. In 1924 the Windsor epidemic of malignant smallpox appeared without warning. The first case was dead and buried before the disease was diagnosed. Of the 67 cases reported, 32 terminated fatally. The epidemic was cut short in the next three weeks by the promptness of action and the efficiency of the health department."

Diphtheria Immunization in Quebec

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THERE is always an element of tragedy in the death of a child from diphtheria. Human nature rebels to see the suffering of the little one, to watch the losing battle to the end and to stand by helplessly during the last convulsive struggle for breath. Even more tragic is the fact that the modern physician knows well that this death might easily have been prevented; in these days there is no excuse for a death from diphtheria.

In the province of Quebec, the death rate from diphtheria in the year 1929 was 14.5 per 100,000 population. In other words, four hundred children were victims of this disease—four hundred deaths which might and should have been prevented. To save these valuable lives and to lower the morbidity due to this disease, it was necessary to stop the infection at its source.

At a meeting of the personnel of the County Health Units, in the first few days of 1930, the order was given by the Director of the Provincial Bureau of Health to begin immunization against diphtheria in those counties organized into full-time Health Units. Thirteen Health Units were then functioning. Immunization was immediately commenced. Others organized since that time have been added to the initial number, and on June 30, 1931, diphtheria prevention was being practised on a large scale by nineteen Units. One year later we had twenty-five Units in operation.

During the year 1931-1932 the older Units continued their work and the newer Units performed their first immunizations. These Units have a territory of 19,500 square miles to cover, or an area equal to that of the states of New Hampshire, Rhode Island and Vermont, or of Massachusetts, New Jersey and Connecticut, or again of New Jersey, Maryland and Delaware combined. These comparisons furnish some idea of the territory which was served and of the travelling which was necessary to do the work accomplished since the beginning of the year 1930. It should be noted, however, that this area did not include those parts of the counties not yet organized into civil municipalities and large bodies of water so numerous in our province, a circumstance which often increased the distance to be covered, as in the rather frequent case where a municipality was located in the middle of an unorganized territory.

It is not our intention to detail here the organization, the methods and the means employed to arouse public opinion and to ensure the success of the undertaking. Suffice it to say that at certain immunization clinics held in many counties from seven to twelve hundred children were present at a time to receive the preventive injections. Our immunization is effected by means of anatoxin (toxoid) prepared by the Connaught Laboratories.

In order to facilitate a comprehensive study of the immunization

work done in the last three years, Table I has been prepared, which shows the numerical and proportional distribution of children, in each of the Health Units, who were given the three injections of anatoxin. The populations shown in this Table are those of the mean year and enumerated as of June 1st, 1931. The total of immunizable children in each Unit was determined from the proportional distribution of the population as given for the province in the Seventh Canadian Census of 1931. Children under ten years of age constitute 24.6 per cent of the total population. It is true that we do not immunize infants up to the age of six months but, on the other hand, we include a certain number of children over ten years of age and this serves as

TABLE I

NUMERICAL AND PROPORTIONAL DISTRIBUTION OF CHILDREN IMMUNIZED IN TWENTY-EIGHT COUNTY HEALTH UNITS DURING THE THREE YEARS 1930, 1931 AND 1932

County Health Units	Population 1931	Distribution of children		
		Numerical		Proportional immunized
		Immunizable	Immunized	
Argenteuil	19,157	4,713	2,273	48.2
Beauce	45,242	11,129	7,611	68.4
Bonaventure	32,766	8,050	6,511	80.9
Champlain*	29,446	7,244	3,938	54.4
Chât.-Lap.-Napierville	34,276	8,432	3,004	35.6
Chicoutimi	57,539	14,155	10,608	74.9
Gaspé-Est/East	28,343	6,972	5,307	76.1
Gaspé-Ouest/West	9,431	2,320	2,400	103.4
Joliette	27,752	6,827	3,363	49.3
Kamouraska-L'Islet	43,707	10,752	11,554	107.5
Labelle	20,181	4,965	3,465	69.8
Lac Saint-Jean-Roberval	51,724	12,724	6,869	54.0
L'Assomption-Montcalm	29,275	7,202	3,031	42.1
Laviolette*	30,454	7,492	3,149	42.0
Lévis	35,889	8,829	7,953	90.1
Lotbinière	23,154	5,996	4,814	84.5
Matane	20,525	5,049	4,181	82.8
Matapédia	25,644	6,308	4,990	79.1
Mégantic	35,678	8,777	6,125	69.8
Nicolet	28,571	7,028	5,996	85.3
Papineau	29,515	7,261	3,072	42.3
Rimouski	33,714	8,294	7,062	85.1
Saint-Hyacinthe-Rouville	39,918	9,820	3,623	36.9
Saint-Jean—Iberville	27,404	6,741	2,173	32.2
Saint-Maurice*	34,120	8,394	5,576	66.4
Témiscamingue	21,705	5,339	3,608	67.6
Témiscouata—Riv. du Loup	50,892	12,519	8,867	70.8
Terrebonne	39,081	9,614	2,596	27.0
The 28 Health Units	905,103	221,844	143,719	64.8

*This Unit began the immunization work in September 1932.

an adequate compensation, so that we may correctly say that the immunizable population is the 24.6 per cent of the total population.

In the twenty-eight Health Units where immunization work was done up to December 31st, 1932, there were 221,844 children who could be immunized. Of this number, 143,719 received the series of three injections of anatoxin and are protected from diphtheria. Nearly two-thirds (64.8 per cent) of the population under ten years of age are now safe from attack by this disease. It is certainly comforting to think of the deaths prevented, of the diminution in the number of those ill with diphtheria in these Units, of the suffering and anxiety spared the parents. Moreover, the possibility of contact has been restricted: every time a carrier expectorates, coughs or otherwise transmits the infective agent, there are now six chances in ten that the disease will not be transmitted, since the diphtheria bacillus cannot attack these refractory subjects. To arrive at an even closer estimate of the real number of children protected, we should add 10 per cent to the proportion given above; this ten per cent represents the children who are only partially immunized, having been given less than three injections. Although not completely immunized, these children contribute in certain measure to the diminution in mortality, morbidity and propagation of the disease, for a slight infection will probably not result in disease by reason of the normal production of antitoxin in their blood in response to the one or two injections of anatoxin which they have received.

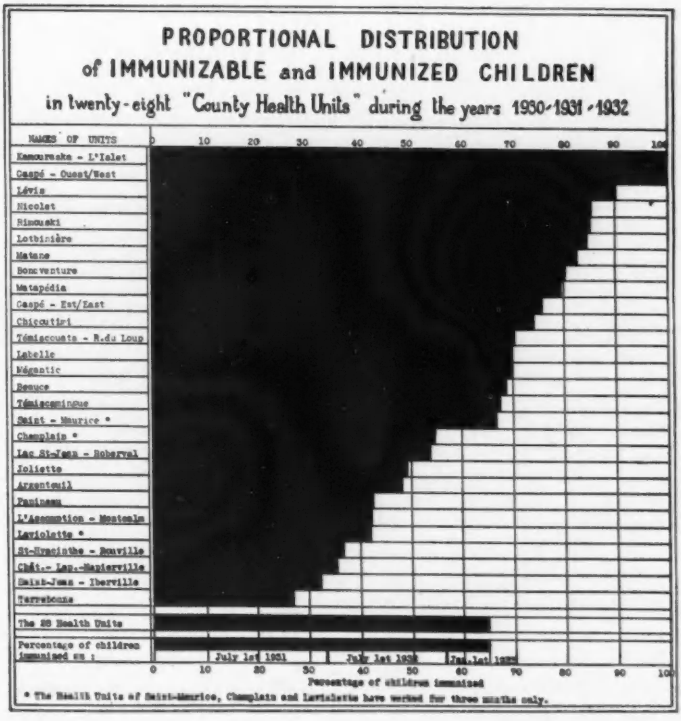
The graph, Figure I, is of particular interest. It shows in each Unit the percentage of children immunized after three years of work, as well as the proportion still to be so protected. Two Units have the places of honour with one hundred per cent complete immunizations: the Units of Kamouraska-L'Islet and Gaspé-Ouest. Every hygienist who has done this sort of work knows the care, the patience, the continued effort which the personnel of these Units had to exercise in order to attain this magnificent result. Seventeen Units, out of the twenty-eight, have immunized sixty-five per cent or more of the immunizable children, and seven others more than forty per cent. There remain only four Units with a proportion of some thirty per cent; and in this connection an explanation, which is not a defence, is pertinent: in two Units it was deemed advisable to concentrate the work on infants and pre-school children in preference to children of school age.

With the progress of the immunization in the whole group of Health Units, the percentage of children immunized has passed from 33.2 on June 30, 1931, to 56.8 one year later, to attain 64.8 on December 31, 1932. This is a notable achievement and we may be proud of the response of the population to our campaign. There is a sufficient number of the children immunized in the counties organized into Health Units to enable us to affirm that these counties are now protected from diphtheria. Furthermore, the map of the province shows the disposition of the Units to be such that they serve as fire-walls between the counties not yet so organized, thus protecting these

neighbouring areas. An epidemic of diphtheria occurring in a county not organized into a Health Unit will die out at the boundary of the neighbouring Health Unit, just as a prairie-fire will be stopped by a stream: if there is nothing for the destroyer to feed upon, its propagation cannot continue.

What has been the effect of this immunization as a diphtheria

FIGURE I



control measure? In order to answer this question we may consider the death-rates since 1926 and our morbidity rates for the year 1932.

From Table II it appears that the death-rate for the province has decreased since 1926; the proportion of this decrease for the whole province, in each of the divisions, will be considered in detail in the next graph, Figure II. All these rates are per 100,000 population.

We have included in the Health Units the twenty-five which carried on immunization up to June 30th, 1932, without regard for their dates of entry into work, so as to show the death-rates in the years previous and those subsequent to immunization.

We have also given a separate tabulation for five cities of Montreal Island where immunization is done, since it is impossible to consider their population as non-immunized. These are the cities of Lachine, Outremont, Verdun, Westmount and Montreal.

In the last city alone, more than 50,000 children are now immunized against diphtheria.

The graph, Figure II, shows that diphtheria mortality is on the wane in this province. If we consider the death-rate for the whole province, we find that it has been quite stable until 1929, except in 1927 when there was an increase due to an epidemic of diphtheria on Montreal Island. But after 1929 the curve drops sharply, corresponding with the practice of immunization in the five cities of Montreal Island and in the Health Units.

MORTALITY FROM DIPHTHERIA

TABLE II

MORTALITY RATES FROM DIPHTHERIA IN THE PROVINCE AS A WHOLE, AND IN FIVE CITIES, THE HEALTH UNITS AND HEALTH DISTRICTS,* FROM 1926 TO 1931 INCLUSIVE.

	Year	1926	1927	1928	1929	1930	1931
Province	Population	2,617,455	2,668,815	2,720,175	2,771,535	2,822,895	2,874,255
	Tot. deaths	367	469	413	401	309	305
	Death rates	14.0	17.6	15.2	14.5	10.9	10.6
Five Cities	Population	820,289	846,396	872,504	898,610	924,716	950,828
	Tot. deaths	137	222	167	122	85	73
	Death rates	16.7	26.2	19.1	13.6	9.2	7.7
Health Units	Population	773,679	783,988	794,297	804,606	814,915	825,225
	Tot. deaths	85	87	100	135	75	64
	Death rates	11.0	11.1	12.6	16.8	9.2	7.8
San. Dist.	Population	964,746	991,436	1,018,126	1,044,816	1,071,506	1,098,202
	Tot. deaths	145	160	146	144	149	168
	Death rates	15.0	16.1	14.3	13.8	13.9	15.3

*The remainder of the province, apart from the five cities and the Health Units, is included under the designation of Health Districts.

We have explained the increase in the rate of 1927 for the five cities; the 1928 rate is about the same as that of 1926; in 1929, immunization was begun and as it proceeded the rate dropped.

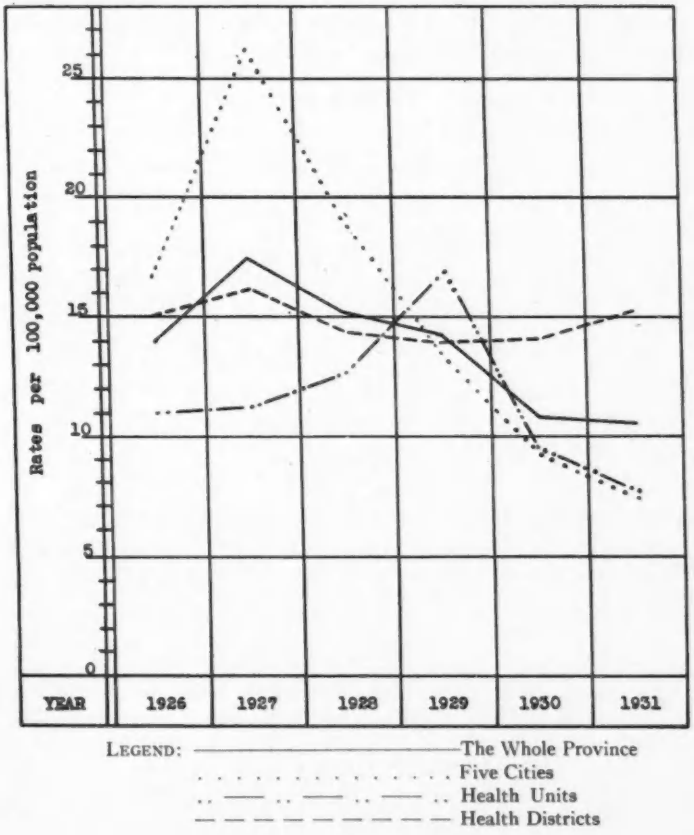
In the Health Units, the mortality remained practically at the same rate through the first three years; the rate increased by 4.0, in 1929, as a result of rather serious outbreaks in certain of the Units such as Terrebonne where there were 22 deaths, Saint-Hyacinthe with 11, Lévis with 19, Papineau with 10 and Mégantic with 8 deaths from diphtheria. These figures are considerably greater than the normal for those Units. In 1930, immunization was started in the Units and the death-rate dropped as the number of children immunized increased. It is interesting to note that in 1930 and 1931 the rates for the five cities and for the Health Units were identical, a coincidence in which immunization has played its part.

What was transpiring during this time in the rest of the province apart from the five cities and the Health Units, which we speak of as Health Districts? What was their contribution to the decrease

in the death-rate for the province? Absolutely nil: their rate was 15.0 in 1926 and 15.3 in 1931. Throughout the period it varied between 14 and 16, the result of chance alone. The Districts merely act as an obstacle to the impetus furnished by the five cities and the Health Units to the lowering of the death-rate in our province.

FIGURE II

Death Rates from Diphtheria, per 100,000 population, in the Province, Five Cities, Health Units and Health Districts, from 1926 to 1931 inclusive.



LEGEND:
——————— The Whole Province
. . . . . Five Cities
.. —— .. —— .. —— .. Health Units
— — — — — — — — — Health Districts

MORBIDITY FROM DIPHTHERIA

What has been the effect of this immunization on the diphtheria case-rate, in 1932? A summary of the cases reported in the Health Districts and Health Units, for the year, appears on the following page. The populations and geographical limits of the divisions shown in Table III are exactly the same as those of Table II. The rates for the five cities and for the whole province are omitted for the sake of clearness. The rates per 100,000 population are monthly annual equivalents, in the table and graph on pages 168 and 169.

According to probability, we should expect practically the same morbidity in two similar portions of the same population; chance may cause a variation of some four per cent in the rate of one or the other portion. On the other hand, we must admit that there is more likelihood of cases being reported in the Units than in the Health Districts. The physician in charge of a Health District may have as many as sixty-five municipalities under his care, whereas the personnel of a Unit has about thirty on the average and detection of cases is effected by four or five persons instead of one. It is, in consequence, reasonable to conclude that the figures returned by the Districts are somewhat deficient as compared with those from the Units.

TABLE III

MONTHLY DISTRIBUTION OF DIPHTHERIA CASES FOR THE YEAR 1932, IN HEALTH DISTRICTS AND HEALTH UNITS

Locality	Population	Repartition	January	February	March	April	May	June	July	August	September	October	November	December	Total
		Cases	69	58	41	44	26	37	30	28	46	53	68	49	549
Districts	964,746	Rates	83.	76.	49.	56.	31.	47.	36.	34.	58.	64.	86.	59.	56.9
Units	835,237	Cases	21	15	5	21	21	20	20	17	12	23	21	11	207
		Rates	29.	23.	7.	31.	29.	28.	27.	24.	18.	32.	31.	15.	24.8

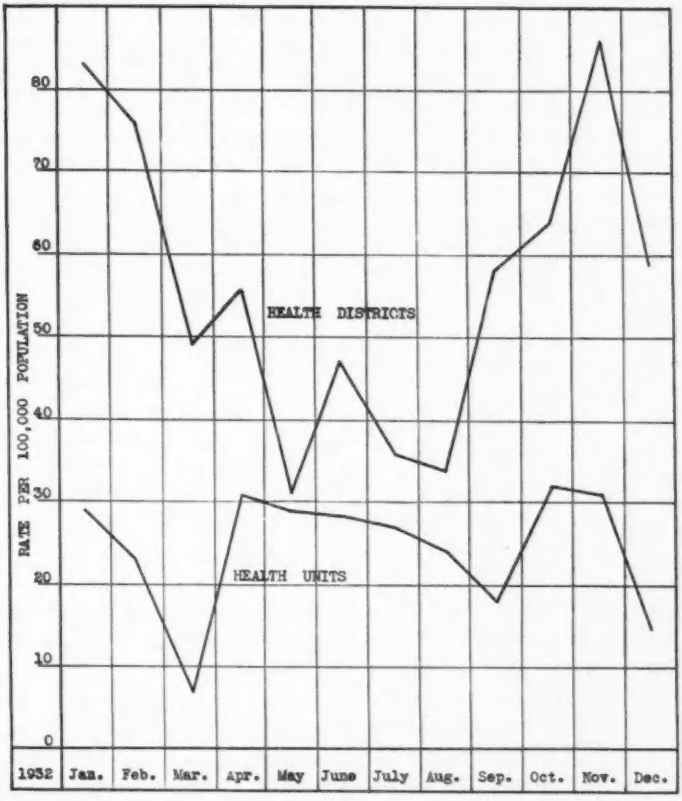
During the year 1932 the Districts had a morbidity rate of 56.9, and the Units, 24.8. It is evident that the rate for the Districts was 56.4 per cent greater than that for the Units. The graph on the opposite page shows the monthly fluctuations in the two groups.

This graph, Figure III, brings out the difference between the monthly annual equivalent rates for the two groups. Not once in the whole year did the rate for the Units reach that for the Districts; it approached much closer in May and during the summer months when the incidence of diphtheria is low, but with the arrival of the colder months and the increasing incidence of the disease, the difference between the two rates becomes more pronounced. There is only one possible explanation of this divergence: the disease is better controlled in the Health Units. This constitutes a practical and tangible demonstration of what can be done by mass immunization of a large population.

CONCLUSIONS

What does the future hold for us, as regards diphtheria? Our morbidity and mortality from this disease will be what we make them. It follows from this study that it is possible so to immunize a whole population as to protect it effectively from this scourge. Let our cities awake to the real menace of the disease and follow the example of

FIGURE III



MORBIDITY RATES FROM DIPHTHERIA (monthly annual equivalent, per 100,000 population), in Health Districts and Health Units of the Province, for the year 1932

the cities located on the Island of Montreal. Let the counties still included in the Health Districts embrace a more complete health program and organize into Units; they will then automatically receive the protection which the Unit can provide.

The Health Units can and must continue the work of immunization; the end to be attained is the protection of every child which may be susceptible to attack by the disease. The work must go incessantly; there always will remain the immunization of babies to be done. A Unit which to-day has covered its territory cannot rest upon its laurels lest it lose the fruit of its labour within a few years. The babies of this year will soon be school children exposed to the disease, and if their immunization has been neglected, diphtheria will again make its appearance in the Unit. In order to keep a population protected, all the little ones must be immunized so that the proportion of the population protected shall be maintained. Herein resides the secret of making diphtheria a disease unknown to our province.

The Pre-School Child and School Medical Inspection

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THE object of this paper is to encourage thought on and discussion of our accepted ideas of school medical inspection, and to propose a method of extending more fully the benefits of preventive medicine to the pre-school group as a whole, including in the scheme a more extensive use of the family physician.

It seems to me that on this continent the guiding minds in school medical inspection are, after twenty years, still trying, by the mere finding of physical defects in school children, to justify their work and its subsequent cost to the public in both the upkeep of the machinery and the direct cost to the families in correcting the defects so found. I think the time is overdue for taking the machine apart to see how it is constituted, to determine carefully its efficiency, and, above all, to see whether it is headed in the right direction.

Finding and Correcting Defects

Nearly all school health systems are built and conducted on similar lines, and, while the procedure may vary somewhat, the objectives are the same in all cases, namely:

(1) Finding and correcting defects.

(2) Controlling communicable diseases.

(3) Promoting hygiene—mental and general.

It is the first item in this group that calls for the greatest expenditure of time and money and it is the *raison d'etre* of this discussion.

Back in the days when public education on this subject was just commencing—and the education is far from complete—it was good business to publish the yearly statistics of the work. These trusty documents could always be relied on to prove to an admiring ("or otherwise") public that the newly enrolled groups of six-year-olds were fine children, except that they exhibited from 35 to 40 per cent of physical defects which the authorities were about to attend to with skill and despatch. This procedure of informing the public of the seriousness of the situation and then reassuring them as to the outcome is a droll paradox that has been repeated year after year with regularity. I think also that a certain amount of reassurance meant for the public is absorbed by those performing the work and by the effectiveness of their own song they are lulled into the belief that the ultimate has been achieved.

Before he examines the classes, any observant school physician of experience can estimate with fair accuracy the types and percentages of the defects he is going to find. Types and percentages of abnormal conditions may

vary geographically, but locally they appear to remain fairly constant. That is, we find about the same percentage of eye, ear, nose and throat conditions from year to year, and other abnormal conditions in like proportions, according to the locality. This very fact indicates that our ideas are in need of revision, because year after year the service as a whole girds up its loins and, with great determination, prepares to discover during the ensuing year that which it already knows exists.

Misplacing the Emphasis

"How can we achieve the correction of defects unless the children are examined and defective conditions recorded?" Quite true, and it is a good work; but the thought arising out of it all is whether or not too much time and money are being spent on the finding and correcting. The emphasis is on the wrong note. All school medical work with which I am familiar has laid great stress on securing the correction of defects. Obviously, existing defects must be corrected; but is this the only message we have to offer the anxious parent? Have we been able to give any assurance that the younger children coming along would be subject to early examination and treatment and be spared, if possible, the inconvenience or dangers of corrective measures? It seems to me that we have read to the parents only the last chapter of the story and have sat back satisfied. I have often wondered if the public is as satisfied as we are self-satisfied.

Let us at this point consider some of the salient features of school medical inspection and how it originated. Its origin was slow and simple and evolved from several facts; namely, that groups of children housed together for teaching purposes were found to facilitate the spread of infection; that they were found to possess defects both physical and mental; that they were grouped together in a suitable place and under such discipline as made physical examinations possible, and by a slight encroachment on school time hygiene could be taught. It looks like an excellent plan, and up to a point it is. Behaviour problems, hygiene and the control of contagion properly belong to the school.

The Pre-School Group

If we could wipe the whole slate clean and, before making a new start, ask those fitted by experience to give an opinion as to what age groups would yield the best results from the standpoint of preventive measures, I think the consensus of opinion would strongly favour the *one to six year* group. In other words, the examination of the school age group was a matter of expediency and opportunity, rather than a selection based on the ideal. I quote here from the report of Sir George Newman:[1]

"The data provided by the inquiry confirm the experience of every school doctor—that it is the physical impairment of the pre-school child which mainly creates the problems of disease in school life."

Every thinking school physician must admit that the amount of grist coming to the mill is lessening but very little. The only conclusion one can

draw, therefore, is that we do not start early enough, and it is quite probable that little or no examining work should be done in the schools.

I carried out, fairly recently, a study that embraced the health history of 1,000 six-year-olds. The study was for the purpose of determining whether intensive school medical work would materially reduce the number of children entering school with uncorrected defects. The pre-school history was obtained by questioning the mother and the result indicated that, to a certain extent, school medical influences do reach back into the homes and motivate parents into action with the pre-school children. The study, roughly, was as follows:

The number of defects previously found in the district in question had been 35 per cent of the newly enrolled, or six-year-olds, over a term of years Subsequent to a period of intensive health teaching, carried out largely among mothers who accompanied children during the physical examination, I noticed that the number of defects recorded diminished gradually until it reached the approximate level of 25 per cent. (This percentage does not include dental defects.)

My first impression was that the drop in the number of recorded defects meant that the children were healthier and were developing fewer defective conditions, but in order to make certain of this point I made a detailed history of the pre-school health of the thousand six-year-olds as indicated above, and a close analysis proved interesting. It showed that approximately 12 per cent of the children had their defects corrected some time prior to entering school, and these corrections were largely influenced by the school health programme. The physical examination in the school revealed that approximately 23 per cent of the group in question needed corrective measures. If we add the percentage of defects corrected in pre-school life to those found at the first examination in school, we still find that the total percentage of children developing defects is in the neighbourhood of thiry-five. In other words, the incidence of defective conditions had not altered over a considerable span of years, although fewer corrections had to be made during school life.

If school medical health inspection does not reach deeper than the ameliorating of existing defects, and I refer only to physical defects and not the control of infection or the promoting of hygiene, then the premises of school medical inspection are not secure. The school health group may hold to their schools, but it is my belief that unless they extend the work into the homes, it will be found that the yearly crop of physical defects will continue at its present level. If this work were achieving the results that it should, is it not reasonable to expect a definite decrease in the incidence of such defects?

While certain utterances in the foregoing paragraphs may appear to be destructively critical, such is not entirely the case. School medical inspection, as at present constituted, has performed an outstanding service for every community which has employed it. Time and, above all, experience alter our point of view; detail emerges from an obscure background and we have a slowly but surely changing picture. We must be cautious, however, to avoid dropping the substance for the shadow, especially in these times of reduced budgets when the public moneys must be expended wisely. Some type of state medicine (health insurance) is in the offing, and if and when it comes,

school medical inspection should be so constituted that it will fit into the new scheme en bloc and without disrupting the service.

The Need of the Pre-School Child

If we review the difficulties that have arisen in the past, and those that still confront us, in respect to carrying corrective and preventive work to the children of pre-school age as a whole, then any plan that would offer a solution, however imperfect at the outset, should be given earnest consideration. It has been amply demonstrated that the pre-school group cannot be reached through the baby and infant welfare clinics, and another approach must be tried. Someone aptly described this period of life as "the neglected age." In many communities the public health authorities are almost prepared to acknowledge defeat. They state that certain small groups can be reached and examined and that a few progressive mothers come forward of themselves. I think, therefore, that it can be safely stated that in the gross the problem of the pre-school child is, at present, inadequately explored and until it is thoroughly explored, who can forecast the amount of good that can be accomplished by sound preventive measures?

Due to lack of information on the subject, it is difficult to estimate what proportion of pathological conditions as found in school could be prevented, but one might ask a few question such as:

(a) Does faulty nose breathing in the toddler predispose to that long chain of conditions which starts with mouth breathing and goes on to hypertrophy of the tonsils and involvement of the sinuses and middle ear, or possible chronic bronchitis?

(b) Why does the hypertrophied tonsil bulk so large in the physical findings? Everyone questions the wisdom of and deplores the necessity for wholesale tonsil enucleation. In a recently published survey[2] Dr. J. T. Phair has pointed out that if the hypertrophied tonsil was eliminated from the list, there would be little left. I wonder if we have accepted this fact too complacently.

I think that there is no need to stress further the desirability of examination early in pre-school life; it is well known. The problem always has been, *How can it be accomplished?*

Suggestions for Amending the Service

There are certain suggestions for amending the service in respect to the duties of doctor and nurse that might be worthy of consideration.

(1) *Doctor*

Reduce the number of routine physical examinations to *one*. Make it of a very thorough nature and carry it out in the first grade. Make it obligatory for a parent to be present and place all future responsibility upon the parent and family doctor and leave it at that; only special examinations, as indicated, to be done thereafter.

Is the constant repetition of the routine physical examination worth what it costs? Personally, I doubt it. With only one routine examin-

ation per child during the public school career, the examining physician is freed of a great many hours of work in the school building. This time might be profitably spent in the homes, advising the mothers on general hygiene and pre-natal care and observing the pre-school group, always working back to the point where defects can be prevented rather than corrected.

Would any great calamity happen if the whole order were reversed and the school doctor did all his work in the home rather than the school? It might improve the race; who knows?

(2) *Nurse*

Does the school nurse spend too much time in the school? Has her system of records, class-room inspection, class-room talks, demonstrations, etc., grown top-heavy? These systems are certainly costly to the taxpayer. Does the money thus spent represent the most that it will purchase in the reduction of disabling conditions? Do talks to the younger groups of children do any good? Is there not a good deal of time and energy expended in fruitless endeavour? Could not a great deal of it be omitted and better results obtained by spending that time in the home. Instruct the teacher. She knows how to impart knowledge to the children; that is her job. Instruct the mothers, in order that they may better teach and care for the infant and pre-school child.

Feasibility of the Plan

On first consideration, various school medical bodies are likely to say, "It can't be done," or, "How could we visit every home?" I quite agree that it is hard to get out of a pleasant rut. I experienced its comfortable confining influences for years, but I realize now that it did not lead me exactly to the goal I anticipated.

Anything can be done that has the sanction of the sovereign people and the people have already accepted school medical inspection in its present form.

Many parents visit the school for the examination. They are invited by card for a definite day and hour, but how often have we been told "I can't stay long, doctor, because I left the baby with a neighbour." And yet that baby is probably more important from the standpoint of its future welfare than the school child one is about to examine. A mother may send a note stating that she cannot come because of the little ones—the very individuals that should be receiving one's attention.

I do not think that resistance to any changes in the present system will come from the homes; in fact, I think the mothers would welcome a new procedure, and is it not reasonable to expect that a mother who would come on a written invitation would likewise stay home to receive the doctor or nurse?

Could the homes of all ratepayers, for an average sized school of 25 rooms, be visited by a nurse once a year? I think they could. Let us make a crude reckoning:

25 rooms=1,000 children at 40 per room; 1,000 children=500 homes, averaging 2 at school; 500 homes at 5 home visits per day=100 days, the first part of each morning; and the balance of the year devoted to the school work as outlined.

The planning of the visiting list could be worked out by blocks, with little or no energy used up by long distances, as most school areas are based on walking distances for children.

The scheme could absorb many of the tasks, now imperfectly done due to lack of personnel and funds, of certain other official and voluntary agencies, thus preventing overlapping of effort and undue number of investigations. It opens the door for mothercraft and child-caring under the proper auspices.

The Relation of the Family Physician

I am well aware that certain municipalities have tried out the plan of paying the family doctor for diphtheria prevention in cases where the family established inability to pay. Detroit obtained excellent results from this modified plan, but I know of no place at present where the whole group, regardless of financial status, is rounded up by the health or school authorities and the family doctor notified to proceed at the expense of the state. I do not think there would be any material difference in the cost to the taxpayer of preventive work done by the official body or the family doctor, provided that a suitable tariff could be laid down between the authorities concerned and the medical associations.

Suppose, for example, an arrangement was made with the medical profession at large whereby the state or municipality paid a flat rate for vaccinations and inoculations of certain accepted types. The foregoing scheme of routine visits in the home lends itself admirably and the *modus operandi* could be as follows:

The public health or school nurse, at each home visit, as outlined above, would leave an official card where she considered inoculations were indicated, and either the parents or the nurse would notify the family doctor. After the work was completed, the doctor would fill in the details on the card. The mother would also sign, vouching for the work done, after which she would mail the card (post free) to the department of public health, which would pay the doctor for services rendered and file the card as a permanent record.

During the nurse's tour she would note certain homes that should be visited by the school physician in order that the more difficult cases could be diagnosed or where the type of advice to the mother was beyond the scope of a nurse. All homes would be visited by the nurse but not by the school doctor. When notifying the family doctor concerning children requiring inoculations, the authorities would at the same time indicate those requiring medical or surgical care. I cannot but think that, once working in the home, the family doctor would find ways and means of doing such other work as conditions warranted; at any rate it places the responsibility where it belongs.

Advantages of this Service

I am fully convinced that this method would satisfy both the public and

the authorities, prove relatively cheap and would, most certainly, be effective. I see many good reasons for its adoption.

(1) It permits of every child in the community being protected against certain disabling diseases and that at an age when it will do the most good.

(2) It will save the taxpayer money in the long run, because it will reduce the incidence of infectious diseases, with its attendant hospitalization. It will, in certain conditions, obviate the necessity for operations during school life and improve school attendance, but, above all, I would hope for a lessening of crippling conditions of all kinds.

(3) It consolidates the position of the family doctor in the home and it definitely introduces him into the field of public health, a position he should share more equitably with the authorities, and it permits the family a private doctor for preventive work without having to bear the expense. It demands that the health authorities and the family doctor meet on a common ground to promote general welfare, the one finding and advising, the other treating and preventing. It further demands a type of co-operation that has not existed in the past.

(4) The department carrying out school public health would continue as at present, except to shift part of its field of activity from the school to the home. This should prove quite simple, because after two or three years the number of children entering school with abnormal conditions would slowly, but surely, be brought to the irreducible minimum, and *diphtheria would cease to be a school problem.*

(5) It would provide the various health departments with statistics as to the protective work being carried out among the pre-school population. Such statistical knowledge is not available at present, and if the best possible use is to be made of our present knowledge in the field of epidemiology, and if we are to weigh accurately the value of preventive practices, these statistics should be in the hands of every health department.

If such a scheme as the above were inaugurated, we might forecast the results as follows: every mother would be seen in the privacy of her own home and, no doubt, every medical skeleton would be brought forth for review. The secluded Mongolian and Cretin, as well as all cripples and helpless invalids, would be located and influences likely to stain or mar the coming generations might, in time, be combated successfully.

It is only by knowing the conditions that exist in the home, in respect to health, mental or otherwise, of every member, that worthwhile advice can be given to the potential mother and such knowledge imparted to her as will lead her to seek the safest and wisest course in relation to the bearing of children.

We have camped on the well-broken trail of the handicapped school child long enough. Let us now break a new trail for awhile, and see whether it will not decrease the number of handicaps now found in that brave, wee champion of the future—the school child.

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Sex Differences in Infant Mortality*

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IT is borne out by all statistics that a marked and fairly constant excess of males over females occurs in human births; *i.e.*, the sex-ratio for live-births, sometimes called the secondary[1] sex-ratio, is in favour of the male. The male sex-ratio of live-births varied approximately between 104 and 105 per 100 females between 1921 and 1930 in England and Wales, while the figure is about 105 or 106 for Canada (Registration[2] Area as of 1921) and similarly for the U.S.A.

How can this fact be explained? Is it due to a higher intra-uterine mortality for female than for male conceptions? Unfortunately, the death-rate in intra-uterine life can only be considered in a very imperfect way. Stillbirths are required to be registered in the various provinces of Canada but the Provincial Act in general does not specify the minimum period of gestation, though this is done in one or two provinces. In the practice of the Dominion Bureau of Statistics, Ottawa, certificates, where the period of gestation is under six months, are not registered as stillbiths, but it must be admitted that in many cases no statement on this point is made on the certificate. In these cases, of course, the certificate is accepted. Accordingly, the question as to whether intra-uterine mortality is greater for female than for male conceptions cannot be answered for the total pre-natal mortality but only for the cases of death after the 6th month of foetal life. If we examine therefore the sex-ratio of *stillbirths* we find that there is a definite excess of males among foetal deaths. The figure for Canada (Registration Area as of 1921) between 1925 and 1930 was 132 on the average, the provinces of Manitoba and Ontario showing the lowest ratios.

TABLE I

STILLBIRTHS AS PERCENTAGE OF TOTAL BIRTHS

Year	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada	Registration Area as of 1921
1921.....				1.8						3.0	3.6
1922.....	3.1	3.4	2.3	1.8	4.2	3.2	2.6	2.6	2.6	2.9	3.4
1923.....	2.8	3.6	2.6	1.8	4.2	3.2	2.7	2.6	3.0	2.9	3.5
1924.....	2.5	3.8	2.5	1.8	4.0	3.2	2.8	2.5	2.7	2.9	3.4
1925.....	2.9	3.4	2.5	1.8	3.8	3.1	2.7	3.0	2.6	2.8	3.3
1926.....	2.0	3.1	2.3	2.3	4.0	2.9	2.6	2.8	3.0	3.0	3.3
1927.....	2.4	3.3	2.7	2.5	3.9	3.2	2.5	3.0	2.7	3.0	3.3
1928.....	2.4	2.9	2.5	2.7	3.9	3.2	2.6	2.8	3.1	3.1	3.3
1929.....	3.0	3.3	2.7	2.7	2.8	3.6	2.5	2.8	2.8	3.1	3.3
1930.....	2.2	3.3	3.1	2.8	3.7	3.2	2.4	2.9	2.4	3.1	3.2

(The rate for Quebec shows an upward trend and the change between 1925 and 1926 is presumably connected with the entrance of that province into the Registration Area for the latter year.)

Paper presented to the Vital Statistics Section of the Canadian Public Health Association at the 21st Annual Meeting, Toronto, May, 1932.

[1]The sex-ratio is a number indicating the proportion of males to every 100 females; the *primary* sex-ratio is the ratio at conception, the *secondary* sex-ratio is that of the living-born and the *tertiary* sex-ratio is that in adults.

[2]The Registration Area as of 1921 in Canada was exclusive of the province of Quebec.

Effect of Decline of the Stillbirth Ratio on the Sex-ratio of Livebirths

According to Tschuproff,[1] when the abortion-ratio (no. of abortions by no. of conceptions) declines and the sex-ratio of conceptions and that of stillbirths remain constant, the sex-ratio of live-births is deviated towards the male side. We should expect, therefore, each decline in pre-natal mortality to be accompanied by an increase in the number of live-born males. Expressing the stillbirths as a percentage of total births (Table 1) we find that the stillbirth ratio has decreased in the course of time—in Canada (Registration Area as of 1921) from 3.6 in 1921 to 3.2 in 1930. The decline of the stillbirth ratio may be represented for Canada, as for most countries, approximately by a curve indicated in Figure 1. Now exponential curves are particularly appropriate

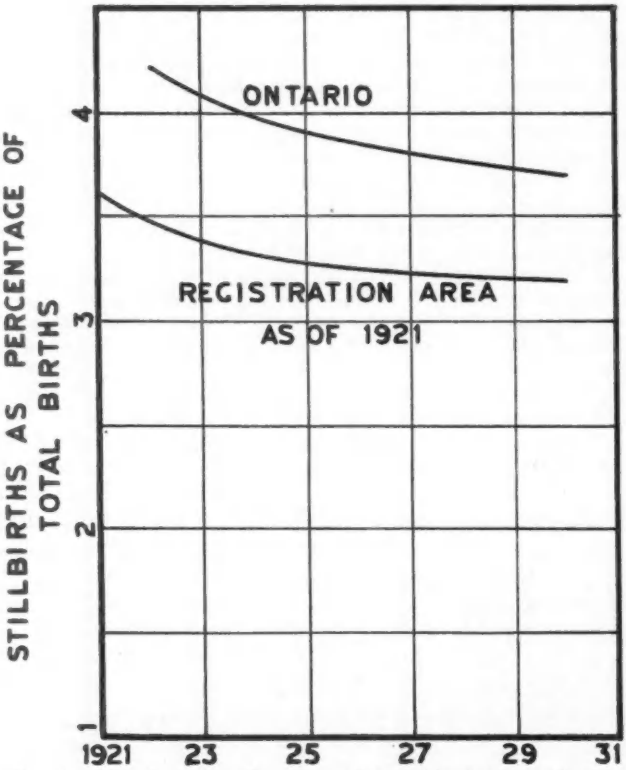

FIG. 1. The curves show the decline of the stillbirth ratio in Ontario and in Canada (Registration Area as of 1921).

for the graphical representation of movements, in which the general trend of the movement does not change and the relative changes in the various time-intervals do not disagree too markedly with each other.

Tracing the course of the stillbirth ratios for each sex separately and using exponential equations to the curves, it can readily be shown (1) that the stillbirth ratios for males (β_m) and for females (β_f) are connected by the differential equation $\beta_m = c\beta_f^h$, where h and c are constants, and (2) that

when h > 1 the relative decline of the stillbirth ratio in the male sex is greater than in the female sex and when h < 1 the reverse applies. By substituting the appropriate values h and c are determined. In most European countries, where statistics of stillbirths are available for a greater number of years than in Canada, the value of h is greater than 1. For Canada (nine provinces) between 1926 and 1929 the value[2] of h exceeds 1. Since h is greater than unity the relative decline in the stillbirth ratio for the male sex is greater than for the female sex. This means, then, that there is a bias in favour of the number of live-born males.

Effect of Neonatal Mortality on the Sex-ratio of Infant Mortality

During the past decade Canada has shared with practically all civilized countries in the decline in the total infant mortality rate. A careful examination of these rates, however, shows that the decline has been confined almost entirely to the period after one month of age, while neonatal rates remain approximately unchanged or only slightly diminished. Considering the figures for 1921-30 in Canada (Registration Area as of 1921) it appears that there has been a slight diminution in the neonatal rate (mortality rate under one month of age) but it has lagged behind the fall in the total infant mortality rate (rate for the whole of the first year) so that the proportion of mortality attributable to the neonatal period is slowly increasing. Table 2 shows the respective rates.

TABLE 2

COMPARISON OF NEONATAL AND INFANT MORTALITY
REGISTRATION AREA AS OF 1921
1921-1930

Year	Infant mortality rates	Neonatal rate per 1,000 live births	Proportion of infant mortality due to deaths in first month
1921	88.1	43.4	49.3
1922	86.8	43.9	50.6
1923	88.1	44.5	50.5
1924	78.5	41.6	53.0
1925	78.6	40.5	51.5
1926	79.9	41.6	52.1
1927	74.6	39.8	53.4
1928	70.9	38.4	54.2
1929	77.0	40.0	51.9
1930	73.2	37.4	51.1

Another interesting feature is brought out from a consideration of the neonatal and total infant mortality rates. The per cent proportion of the male rate of infant mortality to the female rate is generally lower when deaths under 12 months are considered than when deaths under 1 month alone are taken into account. Hence, while male infants are more likely to die throughout the first year of life than female infants, this is particularly true of neonatal mortality. Table 3 shows clearly the superior vitality of the female sex in neonatal and in postnatal life.

[1]Quoted from Burkhardt.

[2]It is recognized that the period is somewhat short to obtain a value for *h*, but the type of curve is suggestive.

TABLE 3

PERCENTAGE OF MALE RATE OF INFANT MORTALITY TO FEMALE RATE

Year	CANADA		REGISTRATION AREA AS OF 1921	
	Under 1 Month	Under 12 Months	Under 1 Month	Under 12 Months
1921			135	135
1922			137	134
1923			135	134
1924			131	129
1925			136	131
1926	140	133	135	133
1927	136	133	134	131
1928	134	131	130	129
1929	138	132	138	131
1930	129	130	126	129

Sex-ratio of Infant Mortality

In discussing the course of infant mortality in England and Wales for the period 1905-22, the Registrar-General points out that the excess mortality of males is apparent at birth, increases very slightly to a maximum in the second month of life and then steadily declines to a comparatively low figure in the 12th month.

The decrease in the sex-ratio during the first *year* of life and its temporary increase during the second *month* are also features of the course of infant mortality in Canada. Table 4 shows the values for each month of the first year of life, calculated by dividing male rates by female rates for the average of the 10 years 1921-30 in Canada (Registration Area as of 1921) and for the average of the five years 1926-30 in Canada (nine provinces); those for England and Wales 1905-22 are inserted for comparison.

TABLE 4

PER CENT PROPORTION OF INFANT MORTALITY RATES OF MALES TO THOSE OF FEMALES
OR
Sex-ratio of mortality (males to 100 females) during first year of life, according to age by months

	1	2	3	4	5	6	7	8	9	10	11	12	Total
England and Wales, 1905-22													
Month													
Ratio	130	134	127	123	121	125	122	120	116	115	113	109	125
Canada (Registration Area as of 1921) 1921-30													
Month	1	2	3	4	5	6	7	8	9	10	11	12	Average
Ratio	134	137	132	136	132	126	126	123	124	134	122	117	125
Canada (Nine Provinces) 1926-30													
Month	1	2	3	4	5	6	7	8	9	10	11	12	Average
Ratio	135	140	130	129	127	124	126	127	125	124	121	119	125

In comparing data on infant mortality according to month for various countries, Holmes and Mentzner have attempted to correlate the increase or decrease of the sex-ratio in the second month of life with the infant mortality rate. They conclude that, as a rule, countries with a *low* infant mortality rate (below 105) show in the second month a higher sex-ratio at death than in the first month, and that countries with a *high* infant mortality rate (over 130) show in the second month a lower sex-ratio at death than in the first month, and a still lower sex-ratio at death after the third month.

This interesting conclusion may be reached and further developed by mathematical considerations. When the figures for infant mortality shown in Table 2 are plotted against time, the striking feature is the concave shape of

the curve considered from the beginning of the co-ordinates; in this way it affords a contrast with the curve for the downward movement of stillbirth mortality. We may therefore represent the course of the mortality in the first year of life by the segment of an ellipse (Fig. 2).

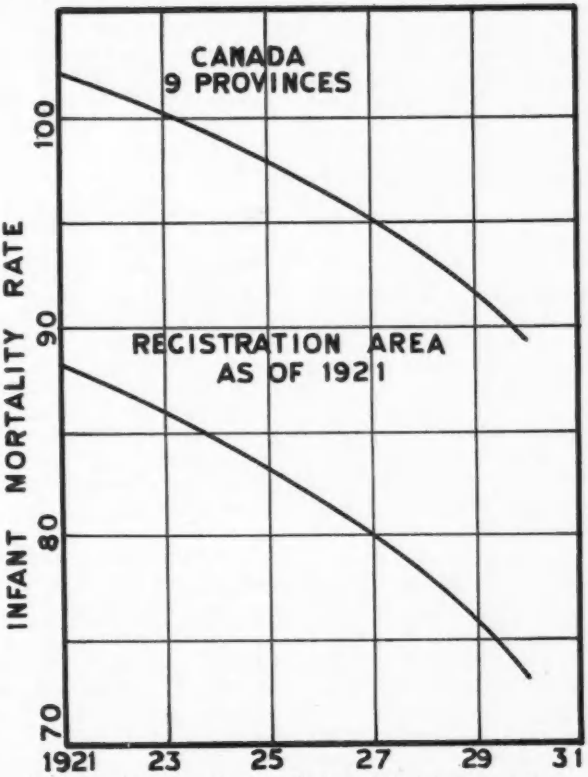

FIG. 2. The curves show the decline of the infant mortality rate in Canada (nine provinces) and in the Registration Area as of 1921.

From the equation to the ellipse a relation can be derived between the male infant mortality rate (γ_m) and the female infant mortality rate (γ_f) viz., $\gamma_m = c\,\gamma_f^k$, where k and c are constants. By substituting appropriate values, k and c are found. The relative decline of the infant mortality rates is greater for the male sex when $k > 1$ and greater for the female sex when $k < 1$. When calculations are made for countries with a *low* infant mortality rate, the value of k is less than 1 as a rule; and for countries with a *high* infant mortality rate k is generally greater than 1. If calculations are made for New Zealand —a country with a phenomenally low infant mortality rate—for the period 1903-23, the value of k is 0.88. This means that the decline of the female infant mortality rate has been relatively greater than that of the male infant mortality rate. The number of years for which statistics in Canada are available is too small to permit of extensive calculations as in New Zealand but the curves shown in Figure 2 are suggestive.

Sex-ratio of Infant Mortality from Causes of Death

Newsholme has called attention to the fact that in many countries whooping-cough almost alone among all diseases has been responsible for more deaths of female infants than male infants. If we consider the sex-ratio of infant mortality from causes of death in Canada (Table 5) we find that whooping-cough and perhaps diphtheria have caused more infant deaths of females than males. The per cent proportion of infant mortality rates of males to females from whooping-cough for the period 1921-25 and 1926-28 was 91 and 92 respectively, and from diphtheria, for the period 1926-28 the ratio was 91.

TABLE 5

PER CENT PROPORTION OF INFANT MORTALITY RATES OF MALES TO FEMALES IN CANADA

Causes of death	Mortality rate of females taken as 100	
	Registration area 1921-25	Nine chief provinces 1926-28
Measles	104	125
Scarlet fever	145	123
Whooping cough	91	92
Diphtheria	127	91
Influenza	133	138
Tuberculosis	124	113
Syphilis	138	125
Bronchitis	117	126
Pneumonia	127	123
Diseases of the stomach	127	117
Diarrhoea and enteritis	128	125
Hernia, intestinal obstruction	159	211

The exceptional character of the sex mortality from whooping-cough may be due, as suggested by Holmes, to the fact that the male possesses a different complex of chromosomes, the nuclei of the cells of the male body lacking a certain amount of chromatin material present in the other sex; or to the different conformation of the male larynx. But the size and form of the male larynx is not apparent till puberty and there is no evidence of an abrupt change in the sex-ratio of this period in Canadian statistics. Besides. the chief complications of whooping-cough are bronchitis and pneumonia and both of these diseases affect the male sex in a greater degree than the female sex.

Table 6 gives the absolute numbers and sex-ratios of mortality from whooping-cough for 1926-30 in Canada. Taking the total figures for the years concerned there is a consistent preponderance of female deaths for each age or age period. The ratio of male to female deaths is highest in the first year of life and thereafter progressively declines.

TABLE 6

DEATHS FROM WHOOPING-COUGH IN CANADA, CLASSIFIED ACCORDING TO AGE AND SEX
(Age in years at death)

Year	All ages		0-1		1-2		2-3		3-4		4-5		5-9		10 +	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1926	545	697	358	415	128	153	37	61	11	18	2	14	7	24	2	12
1927	511	519	336	304	103	132	38	34	12	19	7	13	13	15	2	2
1928	352	375	230	239	70	76	21	18	12	17	9	6	7	15	3	4
1929	381	374	231	223	102	88	19	23	14	14	6	8	7	14	2	4
1930	463	501	345	341	77	108	17	20	12	11	5	8	5	6	2	7
	2252	2466	1500	1522	480	557	132	156	61	79	29	49	39	74	11	29
Ratio of male to female deaths	91		99		86		85		77		59		53		38	

In contrast to the trend for whooping-cough, the sex-ratio of mortality from diphtheria for 1926-30 in Canada is low in the first and second years of life and only after the age of nine does the female exceed the male mortality.

TABLE 7

DEATHS FROM DIPHTHERIA IN CANADA CLASSIFIED ACCORDING TO AGE AND SEX (AGE IN YEARS AT DEATH)

Year	All ages		0-1		1-2		2-3		3-4		4-5		5-9		10-14		15 +	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1926.	480	433	24	23	45	37	60	47	54	42	57	61	171	147	38	44	31	32
1927.	518	494	24	24	44	42	70	54	70	66	60	62	186	167	44	54	20	25
1928.	460	456	22	26	38	50	47	48	67	62	61	50	167	140	37	44	21	36
1929.	486	494	22	21	46	46	54	54	51	50	64	47	180	197	39	42	30	37
1930.	377	360	29	20	37	29	32	38	49	47	43	46	139	119	23	29	25	32
	2321	2237	121	114	210	204	263	241	291	267	285	266	843	770	181	213	127	172
Ratio of male to female deaths	104		106		103		109		109		107		109		85		78	

Discussion

What reasons can be adduced for these facts?—(i) the sex-ratio of live-births shows a slight excess of males, (ii) the sex-ratio of stillbirths shows a definite excess of males, (iii) the ratio of male to female deaths increases as the period of birth is approached, and (iv) the ratio of male to female deaths is higher in the second than in the first month of life in countries with a low infant mortality rate and vice versa.

We may postulate the relative innate frailty of the male gradually approaching equality with the female as the months proceed. The distribution of mortality in the first year of life by weeks and months lends support to this view. Mortality is heaviest in the first week of life and lowest in the second six months, while the decline in infant mortality of recent years is mainly confined to infants over one month.

Of the factors influencing the change in the mortality rate between the first and third months, changes in feeding play a large part if the mortality from gastro-intestinal diseases—one of the three main groups of infant diseases, is taken as an index. The average of the five-year period 1926-30 in Canada (nine provinces) for the per cent proportion of infant mortality from gastro-intestinal diseases (International list nos. 110-113, 118) of males to females was 133.5.

Table 8 shows the deaths by sex and month in which the sex-ratio for the second month reaches the highest value.

TABLE 8

DEATHS (110-113, 118) FROM GASTRO-INTESTINAL DISEASES

Year	1st month		2nd month		3rd month		4th month		5th month		6th month	
	M	F	M	F	M	F	M	F	M	F	M	F
1926	276	191	394	284	447	321	340	250	302	232	193	210
1927	273	195	387	259	397	313	332	274	323	206	255	170
1928	290	196	375	232	387	246	266	247	253	201	194	162
1929	310	189	352	252	358	269	299	208	231	167	203	174
1930	274	230	457	300	396	298	342	254	278	235	229	164
	1423	1001	1965	1327	1985	1447	1597	1233	1387	1041	1074	880
Sex-ratio	142.		148.		137.		128.		133.		122.	

The effect of the decline in the birth-rate on the sex-ratio at death has been invoked. It is argued that countries with a low birth-rate have a relatively large proportion of first births which are apt to be attended with more difficulty and consequent injury to the infant than later births. But Teichmann (1931) has recently produced evidence, from the Breslau figures of the mortality of the first-born during the first year of life in the years 1925-28, to show that we cannot speak of the increased danger to life of first live-births when compared with later births.

Table 9 shows her results, on which the following conclusions are based:—

(a) In all age groups in the first year of life, first births have the lowest mortality (3.57 per cent, 1.84 per cent, 0.55 per cent).

(b) In the age period one to four weeks, compared with the mortality of first births there is an increase of mortality for second births of about 1/9, for third births of about 1/3, for fourth births and for birth group fifth to tenth nearly double and for eleventh births more than double.

(c) The same picture obtains for mortality of infants at the age of two to six months, and of seven to eleven months; hence in the mortality during the further course of the first year of life, as in the mortality of the first month of life, there exists a worse state of matters for each succeeding birth.

(d) The first-born compared with the later-born are more favourably off the older they are, because the difference between the mortality of the first-born on the one hand and the later-born on the other hand increases as age proceeds.

TABLE 9 (modified from Teichmann)

SHOWING MORTALITY OF FIRST, SECOND AND LATER BIRTHS IN BRESLAU, 1925-28 RECKONED PER 100 LIVE-BORN

No. of birth	No. of live-born	Deaths in age-period 1-4 weeks	Deaths in age-period 2-6 months	Deaths in age-period 7-11 months
1	9882	3.57	1.84	0.55
2	8492	3.97	2.38	1.11
3	4819	4.77	3.11	1.41
4	2525	6.57	3.44	1.82
5-10	3289	6.23	3.59	1.98
11 and over	265	11.32	6.04	3.02
Unknown	182	....	....	....

The first-born are therefore more able than later births to withstand the *exogenous* inimical influences which come into play in the first week of life. This can be explained partly by the fact that more care is expended in the treatment of first-born children and as they remain at least for one year the only children in the families, more money is available for their treatment.

Accidents of parturition affect the mortality of the first more than that of the second month of life. The average figure for infant deaths in Canada for 1926-30 ascribed to injury at birth is 104 times as common in the first as in the second month of life and 86 times as common as in the remainder of the first year of life. Hence birth injury tends to make the sex-ratio of mortality much higher in the first than in the second month of life and obscures therefore the influence of such factors as are responsible for the curious rise in the sex-ratio of mortality in the second month of life.

Conclusion

The phenomenon of the inferior vitality of the male sex is apparent before birth, in the first day after live-birth, through every week of the first month and in each quarter of the first year of life. The ordeal of birth which is severe even for a normally developed child—'squeezed by the uterine contractions, buffeted by the walls of the birth canal and semi-asphyxiated by interference with the placental circulation'—is more fatal to the male than to the female. The sex-ratio of infants to succumb to birth injury chiefly in the first and second months of life was 146 for Canada (nine provinces) in 1926-30 and 151 for the Registration Area as of 1921 in 1921-30. Deaths from accidental suffocation, which we might expect to affect the sexes in about the same proportion as the secondary sex-ratio, occur chiefly in the first

month of life. But even the sex-ratio of infant mortality from accidental causes is higher for males than females, the average ratios being 116 for Canada (1926-30) and 122 for the Registration Area as of 1921 (1921-30).

Since the sex-ratios for all groups of diseases are high in the early months and low in the later months of the first year of life, the gradual decrease of the sex-ratio of mortality as age proceeds must be considered as due to a decrease in the susceptibility of the male sex. It is apparent therefore that the course of male mortality is not uniform and that the male sex is at a disadvantage in a greater or lesser degree in prenatal, neonatal and postnatal life.

Summary

(I) The male sex-ratio of live-births for Canada lies between 105 and 106. That this is not due to a higher intra-uterine mortality for female than for male conceptions is shown by the high sex-ratio of stillbirths, the average figure for Canada between 1925 and 1930 being 132.

(II) It is noteworthy that the stillbirth ratios for Canada show a gradual decline which has the effect of increasing the sex-ratio of live-births.

(III) In spite of the marked decline in the infant mortality rate in Canada, the neonatal mortality rate shows only a slight diminution, so that the proportion of mortality attributable to the neonatal period is slowly increasing. Consequently the sex-ratio of infant mortality is lower when deaths under 12 months are compared with deaths under one month (Table 3).

(IV) The decrease of the sex-ratio during the first *year* of life and its temporary increase in the second *month* of life are features of the course of infant mortality in Canada. The conclusion of Holmes and Mentzner that, in general, countries with a low infant mortality rate show a higher sex-ratio of mortality in the second than in the first month and vice-versa is substantiated.

(V) When the sex-ratio of mortality from causes of death in Canada is considered, whooping-cough is almost alone in causing more female than male infant deaths. The ratio of male to female deaths for whooping-cough is highest in the first year of life and thereafter progressively declines (Table 6).

Acknowledgements

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An Outstanding Programme

22nd ANNUAL MEETING

THE 22nd annual meeting of the Canadian Public Health Association is being held in the city of Saint John, New Brunswick, under conditions that constitute a real challenge to our members. After the most careful consideration, the Executive Committee were unanimous in the decision to hold a meeting this year, being convinced that every effort must be made at this time to strengthen the hands of our official departments of health and to aid the nationally organized voluntary health associations in their work. It is only to be expected that many members from Ontario and western Canada will be unable to attend the meeting, but the Committee are most hopeful of a splendid attendance from eastern Canada. A strong local committee has been actively planning for the meeting and arrangements have been made for a most interesting visit to Saint John.

The meeting will commence on Monday afternoon, June 19th, extending over Tuesday and closing on Wednesday afternoon. Two general sessions will be held on Monday and Tuesday afternoons, respectively, with section meetings on Tuesday and Wednesday mornings and Wednesday afternoon. These days were chosen in consultation with the Canadian Medical Association, which will open its general sessions on Wednesday and close on Friday. Saint John will therefore be the medical and public health centre of Canada during the week of June 19th.

Two major subjects have been selected for the general sessions, the subjects of cancer and tuberculosis. On Monday afternoon the sessions will be opened with addresses by the Hon. Dr. H. I. Taylor, Honorary President of the Association, and Dr. Wm. Warwick, President. The subject of cancer will be presented by a distinguished American physician who is internationally known as an authority on the subject. The Hon. Dr. Robb, Minister of Health for Ontario, and the Hon. Dr. Murphy, Minister of Health for Nova Scotia, will discuss the subject of the state responsibility in cancer. This session will not only be of interest to the members of the Association, but will be appreciated by all who are interested in the prevention and control of this disease.

The Tuesday afternoon session will be devoted to the subject of tuberculosis. Two outstanding authorities from

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Great Britain will present papers at this session—Sir Humphry Rolleston, of London, England, and Col. S. Lyle Cummins, of Cardiff, Wales. Sir Humphry Rolleston is one of the most eminent members of the medical profession in Great Britain and is an authority on tuberculosis in all its aspects. Col. Lyle Cummins is also well known on this continent for his extensive research studies in the laboratory aspects of this disease. He is Professor of Tuberculosis in the Institute of Preventive Medicine of University College, Cardiff, Wales. Dr. R. J. Collins, of Saint John Tuberculosis Sanatorium, Dr. W. J. Bell, Deputy Minister of Health for Ontario, and Dr. F. C. Middleton,

GENERAL HOSPITAL, SAINT JOHN.

Deputy Minister of Health, Saskatchewan, will join in this symposium on tuberculosis. A report on the work of the Health Organisation of the League of Nations will be presented by Dr. J. G. FitzGerald, Dean of the Faculty of Medicine and Director of the School of Hygiene and Connaught Laboratories, University of Toronto, who is Vice-President of the Bureau of the Health Organisation.

The programme provides for three section meetings in Vital Statistics, two meetings of the Laboratory section, one meeting of the section of Public Health Nursing, and one additional section meeting at which technical papers in the administrative health field will be presented. The section programmes are of very high order and will be published in detail in the May issue of the JOURNAL.

Public Health in New Brunswick

THE HON. H. I. TAYLOR, M.B., C.M. (Edin.), LL.D.
Minister of Health, New Brunswick; Honorary President, Canadian Public Health Association.

PUBLIC health history was made in New Brunswick when in 1918 the legislature passed the Public Health Act of that year. By that Act the old system, with its provincial board of health and local boards, with not one full-time medical health officer, with boards of health other than the civic ones meeting only in cases of emergency and not always then, went into the discard and a new organization was set up under a responsible Minister of the Crown. This was the first instance in the British Empire when there was a minister of health in a Cabinet. Since that time, however, many countries and provinces have established a portfolio of health in their Cabinets and in the past decade the importance of health has been more fully recognized as a necessary part of governmental endeavour.

The Hon. Wm. F. Roberts, through whose vision and energy this remarkable change was brought about in New Brunswick, became the first Minister of Health when the Act was proclaimed in 1918 and he immediately began the organization of his department.

Dr. Roberts chose as the administrative head, Dr. George G. Melvin, D.P.H., who was then Medical Health Officer (part-time) of the city of Saint John. Just at that time the 1918 pandemic of influenza reached the province and with a skeleton organization of three district medical health officers and a newly established provincial laboratory, but with no organization yet in effect in the counties, the Department of Health received its "baptism of fire." To those who worked through that pandemic with already well established departments, the difficulties encountered by this very young child may be well understood. Fortunately, the public was impressed with the necessity of a modern health organization and this did much to make possible the further developments along modern lines.

By the beginning of 1920 the counties had completed the organization of the sub-district (county) boards of health with the district medical health officer as chairman of the boards in his district. Working under uniform regulations drawn up for the whole province, these

boards have fully demonstrated the value of the plan as provided for in the Act, whereby the control of notifiable diseases and matters of sanitation became a principal function of such boards.

In this same year New Brunswick began the collection and compilation of vital statistics for the whole province under the control of the Department in collaboration with the sub-district boards and their registrars. The wisdom of placing this service under the Department of Health has been fully borne out by the results which have been obtained, for it would appear after twelve years that they have a system which will bear comparison with that of any other part of Canada.

In 1919 a system of medical inspection of school children, both rural and urban, covering the whole province, was established. With the exception of the city of Saint John, this service was provided by local physicians on a part-time basis. Such a part-time service, however, was found not to be satisfactory and in 1922, through the co-operation of the Rockefeller Foundation a medical inspection service, provided by six full-time medical officers covering the schools of the entire province, was established. For two years the Foundation bore the expense of this service, since which time it has been carried on in its entirety by the Department. In the completeness of this service of medical inspection of schools this province appears also to have led the rest of the Dominion.

Both the Public Health Act and the Schools Act require that no child shall attend school unless successfully vaccinated against smallpox, with the result that more than 150,000 children have been so vaccinated since this Act went into effect. This means that 1-33 of the population is vaccinated every year, with the result that whereas in 1919 there were nearly 4,000 cases of smallpox, not a single case has occurred in the last two years.

DR. WM. WARWICK, D.P.H.
Deputy Minister of Health, New Brunswick;
President, Canadian Public Health Association

As time went on other services were gradually organized. Public health nursing, though beset with many difficulties, has become an important branch of the Department. At the present time they have a director and five full-time field nurses with five other public health nurses supported by local communities but subsidized by the

Department and working under the director. Several other nurses in the province do a limited amount of public health work in collaboration with the service.

The Public Health Laboratory, established in 1918, is located in the General Hospital in Saint John and from a very modest beginning in the old hospital now occupies a wing in that fine new building. Under the able direction of Dr. H. L. Abramson, this laboratory has continued to develop the various services provided in such an institution and, in addition, performs all the laboratory work for the hospital. It is also the central serum depot through which the Department's twenty-six serum depots in various parts of the province are kept supplied with stocks of biological products, diagnostic outfits and other such material.

In 1924 a travelling tuberculosis diagnostic service was begun with one diagnostician. In 1927 a second diagnostician was appointed and since that time this service has been continued with increasing satisfaction and with appreciable results beginning to manifest themselves in the decreasing mortality rate from that disease.

Among other services provided by the Department within the last few years have been free diphtheria toxoid inoculations for school and pre-school children. These have been largely carried on by the Department's own officers and have resulted in more than 50,000 children completing the series of inoculations.

Through the exigencies of public life the Hon. Dr. Roberts was in 1925 succeeded by the Hon. Dr. H. I. Taylor, who has most ably furthered the advancement of public health in the province.

For obvious reasons the expansion of activities has not been possible during the past three years but during that time efforts have been made to co-ordinate and improve what has already been established, with the hope that the beneficial effects upon the health and well-being of the people might in no way be lessened.

At the close of 1931, Dr. Melvin, the Chief Medical Officer since 1918, found it necessary to retire because of failing health and passed away but a few months later.

To Dr. Melvin New Brunswick owes much for the very many years he laboured so arduously and successfully in establishing a department of health fitted to cope with health problems of the present day.

Saint John, N.B.

June 19 to 21, 1933

EDITORIALS

HEALTH HAZARDS IN INDUSTRY

CANADA is more widely known as an agricultural country, but in 1929 industry shared almost equally with agriculture in the net value of its products. Seven hundred thousand wage earners, with their dependants, constitute nearly one-third of the total population, a group with tremendous influence on the public health.

The medical officer of health, in his concern for the health of the community, or the family physician, confronted with illness in the wage earner, cannot afford to ignore the influence of occupation, which is second only to age in its effect upon health.

The wage earner carries to his home the influence of his calling, particularly the attitude he meets towards health at his work. The individual factory gives expression to this attitude in its arrangements for the care of industrial accident or occupational disease cases and the prevention of general sickness, for which it at present assumes no responsibility except that dictated by the demands of good business.

Legislation and inspection are left far behind under these conditions, while the services of the physician, chemist and the engineer are enlisted to protect and control special hazards, whether arising out of the use of dangerous substances or due to the more subtle effects of daily practices harmful to proper physiological function and reflected in general ill health.

The appraisal of the relative importance to health of industrial practices avoids waste of funds and secures results which pave the way for the intelligent application of the principles of preventive medicine to an important section of the community. The conditions are peculiarly suited to the best results, for here are groups of adults assembled daily, readily accessible, and with a profound influence upon family life. In this issue of the Journal Dr. F. M. R. Bulmer outlines in proper perspective some of the common industrial health hazards.

The medical officer of health has the confidence of industrial executives in his community, with whom lies the initiative.

J. G. Cunningham.

LABORATORY SECTION

*The Use of the Methylene Blue Reduction Test**

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THERE seems to be no advantage in unnecessarily assuming exaggerated virtues or faults for the methods at present available for the quantitative estimation of bacteria in milk. Considerable research in recent years has given a clearer conception of the place of these methods in a milk control programme than was formerly held.

The methylene blue reduction test possesses sufficient virtue and yields sufficient information regarding the bacterial condition of milk to have won an important place in milk control work since first suggested by Neisser and Wechsberg thirty-two years ago. Its use has become so general on this continent that it is now one of four standard methods recognized by the American Public Health Association. It is employed very extensively in Europe, and on milk received at the butter factories of Denmark its use is mandatory. Like all other biological tests, it has certain advantages and disadvantages which dictate its sphere of usefulness. If these are to be understood and if the test is to be used intelligently and the maximum information obtained from it, its underlying principles must be recognized. Therefore, a brief discussion of the mechanism of reduction is presented.

The Mechanism of Reduction

The older conception of the reduction of methylene blue in milk was that the growing bacteria elaborate an enzyme, reductase, which reduces the dye. This theory is untenable at present, since it offers no explanation for the reduction of methylene blue on the removal of oxygen from sterile milk, milk of low bacterial content, or synthetic milk (Barthel, 1925). It provides no link between the reduction of methylene blue by such metabolites as lactose, the sulfhydryl compounds, citrates, succinates, etc., and the reduction of the dye by milk or the immediate reduction of certain other days in fresh, aerated milk of low bacterial content. It allows for no relationship between the reduction of dyes in milk or other organic complexes, and oxidation-reduction (O-R) potentials.

A much more satisfactory explanation places the dependence of dye reduction upon O-R potentials. Methylene blue reduces in milk over a narrow O-R potential range which varies slightly in different milks. This potential is reached by decreasing the dissolved oxygen in the milk. It is probable that all organic complexes respire evolving hydrogen and combining oxygen. While sterile milk will slowly do this, it is improbable that the amount of oxygen combined by the milk during the interval of the reduction test is sufficient to have any practical significance. It is probable that the hydrogen produced by the constituents of the milk combines with the dissolved oxygen and, according to the theory of Wieland, forms H_2O_2. As the free oxygen is taken out of solution the O-R potential falls ultimately through the range of the methylene blue-methylene white reaction. At these potential values the hydrogen (under certain conditions it may be an electronic transfer rather than a hydrogen transfer) reduces, not the oxygen, but the methylene blue which up to this point has remained inert in the milk. It is probable that in non-sterile milk the growing bacteria consume the free oxygen dissolved in the milk till the potential is reached, at which the hydrogen from the hydrogen donators attaches itself to the methylene blue rather than to the oxygen. The period necessary for this point to be reached, the milk being held at body temperature, is the methylene blue reduction time of that milk. That the bacteria play an oxygen-consuming role and that the dye is reduced by hydrogen from metabolites in the milk is a theory first propounded by Barthel (1917) and is supported by Thornton and Hastings (1929, 1930). The reader is referred to the work of these authors for a fuller discussion of the mechanism of reduction than space allows here.

It has not as yet been definitely proved that reduction of the dye does not take

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place either at the surface of, or within the bacterial cell. A theory that the major portion of the dye is reduced in this way seems superfluous in view of the reduction of dyes in milk and other solutions in the absence of bacterial cells.

SOME INACCURACIES OF THE TEST

Thornton and Hastings believe that two important sources of inaccuracy in the reduction test are:

1. Different rates of oxygen-consumption by different species of bacteria.
2. The sweeping of bacteria out of the milk by the rising butterfat during the test.

Variation in rates of oxygen-consumption

There is at present insufficient knowledge regarding oxygen-consumption rates of different species of bacteria to justify an estimation of the extent of inaccuracy introduced into the test by this factor. Such a knowledge would be of questionable value since in the practical application of the test mixed species are present in unknown proportions. This inaccuracy is minimized by the tendency for *Streptococcus lactis* to predominate in those milks to which this test is applicable.

Effect of Creaming on Accuracy of Test

The variability and inaccuracy introduced by the creaming of the milk are sufficient to limit the reduction test in practice to milks of rather short reduction times.

Thornton and Hastings recommend that the standard test be not considered reasonably accurate after the five and one-half hour period as suggested in Standard Methods of Milk Analysis.

Johns (1930) places the limit of reasonable accuracy at ten hours and comments that Thornton and Hastings "offer little data in support of their contention." Working with 135 samples of milk supplemented by a recalculation of similar data on 168 samples reported by Ellenberger et al, Johns based his conclusions entirely upon reduction time variations in duplicate tubes and overlooked his results with 5 samples in which creaming was prevented by shaking. In the case of each of these latter milks, all of which had standard reduction times varying between six and eleven hours, the sweeping effect of the rising butterfat was great enough to introduce serious inaccuracies. Thornton and Hastings, on the other hand, based their conclusions on the reduction time variations in replicate tubes of 108 samples of milk and the decrease in the reduction time in 106 of these samples when creaming was prevented. While uneven distribution of the bacteria in the milk during the test is the cause of variations in the reduction times of duplicate samples, the extent of such variations is not as good a measure of the accuracy of the reduction test as is the decrease in reduction time when bacterial distribution is kept uniform.

A reduction time of five and one-half hours does not represent a sharp line of demarcation between accuracy and inaccuracy. Any degree of accuracy chosen as desirable will necessarily be an arbitrary one. It is probable that the increase in inaccuracy tends to follow the growth curve of bacteria, which means that the inaccuracy increases very rapidly as the reduction time increases. This can be shown by a mathematical analysis of the data in question.

Assuming that there are 20 million bacteria per cc. in milk at the moment of reduction and that the generation time during the test is one hour (these assumptions probably approximate the average), then the relationship between the reduction times and the approximate number of bacteria per cc. in the original milk is as follows: eleven hours represent 10,000 bacteria, eight hours represent 75,000 bacteria, six hours represent 300,000 bacteria and four and one-half hours represent 900,000 bacteria in the original milk. When the standard reduction time is eleven hours the average reduction time, if the bacteria are kept evenly distributed by shaking, is eight hours, according to the data of Thornton and Hastings. In terms of the number of bacteria in the original milk this would mean that the milk tested would be assumed to have 10,000 bacteria per cc., when 75,000 would be more nearly correct. Such a variation is undoubtedly higher than the average variation of the plate count. When the standard reduction time is six hours, the average reduction time, if the tubes are shaken, is four and one-half hours. In terms of the number of bacteria in the original milk this would show 300,000 per cc., while 900,000 would be more nearly correct. This more nearly approaches the average variability of

the plate count. Thus the evidence does not seem to warrant extending the time limit set forth in Standard Methods of Milk Analysis.

If this conclusion is correct then the methylene blue reduction test in its standard form is applicable only to poor and middle class milks, since a milk reducing in five or six hours is not what is considered to-day a good milk. In terms of interest to the public health official this means that the test may be advantageously used in a milk improvement program until such time as a large proportion of the milk will remain unreduced beyond the five and one-half hour period. When this stage has been reached it is necessary to adopt one of the other tests, probably the plate count, if further improvement is to be made. This stage has already been reached in some Canadian cities.

Effect of Creaming Temperatures on Reduction Times

Since variations in the reduction times in replicate tubes are influenced by the creaming of the milk, then anything affecting the creaming properties of the milk, such as creaming temperatures, will also affect these variations. This fact seems to have been overlooked by Fay (1930), who endeavored to use refined technique in a study of the variability of the methylene blue reduction test. It is probable that in many cases he introduced inaccuracies greater than the normal variation when the standard technique is used. The effect of creaming temperatures upon the reduction times and variations of four samples of milk is shown in Table I. In this table "Time" is the average reduction time of 10 to 20 replicate tubes in hours and minutes. The columns headed "Variation" show the extreme variation between replicate tubes. One hundred cc. of standard dye solution (one tablet added to 200 cc. sterile water) were mixed with 1 litre of milk. The 10 cc. portions were measured into clean, sterile test-tubes by means of a dipper and the constant temperature waterbath was held at 37 degrees C. The various treatments then given the milks were as follows:

Treatment A. Standard technique was used except for the addition of dye noted above.

Treatment B. Tubes, replicates of those in A, were creamed in ice-water for one hour and then placed in the bath.

Treatment C. The remaining bulk milk was creamed in ice-water for one hour when, after shaking, the 10 cc. portions were measured into the tubes, which were then placed in the bath.

Treatment D. Tubes, replicates of those in B, were held in the ice-chest for seventeen to nineteen hours and were then incubated in the bath.

Treatment E. The remaining bulk milk was held in the ice-chest for seventeen to nineteen hours and was then shaken. Ten cc. portions were then measured into test-tubes which were incubated as usual.

TABLE I

The effect of various creaming temperatures and treatments upon reduction times and variations in replicate tubes.

Sample	Treatment									
	A		B		C		D		E	
	Time	Variation	Time	Variation	Time	Variation	Time	Variation	Time	Variation
1	4:45	0:00	5:00	0:00	....	....	....	....	4:00	0:00
2	5:38	0:20	5:36	0:45	4:50	0:10	5:54	0:15	4:52	1:00
3	2:30	0:00	6:25	0:35	2:45	0:00	6:35	1:15	2:00	0:00
4	3:53	0:15	4:30	0:20	4:05	0:00	4:30	0:00	4:00	0:00

The data presented in Table I have a very significant practical bearing. There are at present no standard methods for the manipulation of the samples of milk prior to making the test, and different practices are follow-

ed by various workers. In the absence of such standards, the need for which is quickly revealed by scrutiny of this table, it is recommended that the milk in the tubes be shaken immediately prior to being placed in the bath. This will ensure recreaming at a uniform temperature of 37 degrees C. and will tend to bring the milk into oxygen-equilibrium with the atmosphere. It is not anticipated that this will remove entirely all inaccuracies introduced by manipulation of the milk prior to the test but the tendency is in the direction of greater accuracy and uniformity.

Standard Methods of Milk Analysis suggests dividing milks into the following four classes based upon reduction times and recommended by Barthel and Orla-Jensen:

Class 1. Good milk, not decolorized in five and one-half hours, developing, as a rule, less than one-half million colonies per cc. on agar plates.

Class 2. Milk of fair average quality, decolorized in less than five and one-half hours but not less than two hours, developing, as a rule, one-half to four million colonies per cc. on agar plates.

Class 3. Bad milk, decolorized in less than two hours, but not less than twenty minutes, developing, as a rule, four to twenty million colonies per cc. on agar plates.

Class 4. Very bad milk, decolorized in twenty minutes or less, developing, as a rule, over twenty million colonies per cc. on agar plates.

In view of the ease with which low count milk can be produced because of our present knowledge of the sources and extent of bacteria contamination of milk, there seems to be no reason for public health departments in Canadian cities being interested in at least the last two of the above classes. Indeed, the city of Edmonton is at present rejecting all milk which, after the producer has received warning, has a reduction time below five and one-half hours. In the opinion of the writer this is sound practice. Nevertheless, while the above classification is recognized, a discussion of the soundness of that classification is pertinent.

Variations in Reduction Times From Other Causes

Different manipulations of the sample of milk up to the start of incubation at 37 degrees C. may cause variations greater than the time expanse of Class 4. This is illustrated in the following experiment. A sample of milk containing the standard concentration of methylene blue was incubated at room temperature. Two hours after reduction had taken place the milk was shaken until the blue color had returned and a large number of 10 cc. portions were measured by dipper into tubes. With the exception of those in Lot 3, these tubes were sterile. The tubes were then divided into 4 lots and treated as follows:

Lot 1. With the exceptions noted above, standard procedure was followed.

Lot 2. The tubes were immersed in ice-water for thirty minutes and were then incubated in the usual way at 37 degrees C.

Lot 3. (Non-sterile tubes.) These were immersed in ice-water for thirty minutes, were then shaken and incubated in the usual way.

Lot 4. These tubes were held in ice-water for twenty minutes, then shaken and again held in ice-water for thirty minutes. The reduction time at 37 degrees C. was then noted.

The results obtained are given in Table II. The standard reduction time is the period between the placing of the tubes in the 37-degree C. water-bath and the reduction of the dye. No variations were observed in the reduction times of any replicate tubes within any one lot.

TABLE II

The effect of incorporation of oxygen upon the reduction time of milk the true reduction time of which is zero.

Lot Number	1	2	3	4
Reduction time	0:20	0:17	0:55	0:40

It is improbable that these differences are due, to any great extent, to the influence of creaming of the milk. It is more probable that the extended reduction times are caused by the incorporation of oxygen during shaking. The inaccuracy thus caused cannot be greater than one generation period of the bacteria unless shaking or other means of introducing oxygen into the milk is continued over a longer period of time than is likely in practice. This is due to the fact that half the total number of bacteria (oxygen consumption is proportional to numbers of growing bacteria in any one sample of milk) present in the milk at the moment of reduction grew in the last generation period before reduction. Thus, if a milk is brought into oxygen-equilibrium with the atmosphere immediately following reduction, its second reduction time will be one generation period. These figures show the necessity for revising our conception of the meaning of Classes 3 and 4 in the above classification. Milk already with a true reduction time of zero, may be placed in Class 4 and even in Class 3 by the usual manipulations of the sample.

The work of Fay cited above would seem to throw doubt on the soundness of the use of certain simplified techniques, such as the use of a 10 cc. dipper and boiled glassware, which have made the methylene blue test so acceptable in practice. The data presented in the present paper indicate that Fay introduced larger errors by the incorporation of oxygen and by increasing the creaming properties of his samples than are caused by some of the techniques he studied.

SUMMARY

1. A brief review of the mechanism of reduction is given.
2. An analysis of existing data is made which shows that the standard methylene blue reduction test should not be considered reasonably accurate after the five and one-half hour period.
3. Temperatures of creaming during the sampling and testing of the milk are shown to influence reduction times. To minimize the inaccuracies thus introduced in practice, it is recommended that the tubes containing the samples be shaken sufficiently to mix the cream with the milk immediately before placing in the water-bath.
4. The introduction of oxygen during the manipulations incident to the test may cause a milk with a true reduction time of zero to be placed in Class 4 and even Class 3 of the classification suggested in Standard Methods of Milk Analysis.

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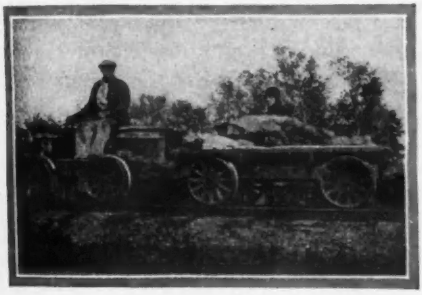
PUBLIC HEALTH NURSING

Nursing in a Red Cross Outpost

MINNIE E. BARTLETT, REG.N.

Kakabeka Falls, Ontario

NURSING in a Red Cross outpost embraces every type of nursing service: bedside care in the outpost and in the district homes, prenatal and infant welfare, and pre-school, tuberculosis and communicable disease work. It is not merely a personal service, but a community service; one that touches society at many different points. The aim of the Red Cross nurse is to give understanding consideration to every community interest. The idea that nursing means only the physical care of the patient and his environment is no longer accepted; cases of a social aspect now occupy a large part of the nurse's time.



A Red Cross nurse taking a patient to the nearest surgeon by the only means available—and thereby saving his life.

Qualifications for Red Cross Nursing.

The nurse undertaking work in a Red Cross outpost should have a well-rounded hospital training, with special training in public health nursing and some previous experience in the nursing field. Owing to the fact that many patients live in not easily accessible places, many miles from a physician, the nurse is often called on to assume responsibility that requires all the knowledge she can command. Good health, obviously, is essential; the nurse must be able to respond to every call regardless of weather, time or distance. Not the least desirable qualification is the proverbial sense of humour, which goes far towards lessening the disappointments encountered in the day's work.

Prenatal and Natal Care.

Prenatal and maternal work are important divisions of the Red Cross service, although in many cases the expectant mother does not make known her condition until labour begins. This undoubtedly is one cause of Canada's high infant and maternal mortality rate. Owing to various factors—poverty, the distance from a physician and ignorance of the value of such attention during the term of pregnancy, for many of these

The second lap of this patient's journey to the outpost; first by freight and then by wagon.

mothers medical care is not possible. It is these cases that have reason to value the Red Cross outpost service. When the distance is not too great, many come to the outpost; others summon the nurse for delivery in the home. There, by teaching and literature, she strives to emphasize the value of early prenatal care. Twice a month infant welfare conferences are held at the outpost. To these, infants and pre-school children are brought by their parents to be weighed and advised about diets and health habits. The conferences are well attended and afford an excellent opportunity for adult health education.

School Health Work.

School health work forms an important part of the service given by the Red Cross. Periodic health inspection and health talks in the school stimulate interest and develop intelligent attitudes towards health and the forming of correct health habits. Junior Red Cross branches, organized in the school, have a distinctive and very helpful part to play in fostering better health habits among the pupils, who in turn carry this training to their homes. The correction of defects is an important part of the school health work. In this connection, it is necessary that the nurse familiarize herself with all the agencies and other sources of help that can assist her in providing glasses and medical aids for those pupils whose parents are unable financially to obtain them.

Communicable Disease Work.

One of the most important activities in public health work is the immunization of pre-school and school children from diphtheria and smallpox. It is no easy task to convince parents of the value of protection against these diseases, but our Red Cross nursing service is gradually accomplishing this end, with the result that many hundreds of children have been protected against these diseases.

To sum up in a few words, the goal of the Red Cross nursing service is, to quote the words of Sir George Newman:

"To defeat disease and to lengthen man's days, but still more in the ultimate issue to emancipate the imprisoned splendor of the human spirit."

REPORTED CASES OF CERTAIN COMMUNICABLE DISEASES IN CANADA* BY PROVINCES—FEBRUARY, 1933

Diseases	P.E.I.	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Diphtheria	1	6	10	94	50	21	23	10	57
Scarlet Fever	—	15	18	355	295	73	90	13	36
Measles	—	82	28	493	1489	4	5	24	198
Whooping Cough	—	16	1	613	437	116	122	13	79
German Measles	—	—	—	8	8	—	3	—	1
Mumps	—	—	—	205	891	111	4	2	42
Smallpox	—	—	—	—	—	—	33	—	—
Cerebrospinal Meningitis	—	1	1	1	4	—	2	2	2
Anterior Poliomyelitis	—	—	—	8	—	—	—	—	1
Typhoid Fever	—	2	3	68	19	26	3	3	5
Trachoma	—	—	—	—	6	—	3	—	52

*Data furnished by the Dominion Bureau of Statistics, Ottawa.

NEWS NOTES

Annual Meeting American Public Health Association

THE American Public Health Association announces its sixty-second annual meeting, to be held in Indianapolis, Indiana, October 9-12, 1933. It was in Indianapolis in 1900 at the twenty-ninth convention of the Association that Dr. Walter Reed read a paper entitled "The Etiology of Yellow Fever—A Preliminary Note," indicating that the mosquito serves as the intermediate host for the parasite of yellow fever. At the sixty-second annual meeting it is planned to honour the only living participant in the famous yellow fever experiment, Dr. John R. Kissinger, at a special memorial session.

British Columbia

DR. STEWART MURRAY of Vancouver is engaged in post graduate work in the School of Hygiene, University of Toronto.

The Pacific Northwest Medical Association meeting will be held in Vancouver from July 4th to 7th. Among the speakers expected are the following: Dr. Wm. Boyd, Winnipeg; Dr. J. G. FitzGerald, Toronto; Dr. A. H. Gordon, Montreal; Dr. C. H. Best, Toronto; Dr. A. T. Bazin, Montreal; Dr. D. E. S. Wishart, Toronto; and Dr. A. R. Mathers, Winnipeg.

Alberta

DR. W. H. HILL, a graduate of the School of Hygiene, University of Toronto, 1932, has been appointed Medical Health Officer of the city of Calgary and Superintendent of the Calgary General Hospital to fill the vacancy created by the retirement of Dr. Duncan Gow.

Saskatchewan

THE Regina and District Medical Society is taking an active interest in the development of socialized medicine. A committee on contract practice has been appointed. The society has already drafted a detailed scheme for the provision of medical care for the indigent sick of Regina. Through the co-operation of the City Health Officer, Dr. Coles, this has been presented to the civic council. The committee on contract practice is holding conferences with several large employee groups and negotiations are under way for voluntary sickness insurance among these people. Those entering the scheme are to have free choice of a doctor. It has been suggested that a fee of thirty dollars per capita be contributed yearly to a sickness fund. The medical fees are to be paid from this fund. Problems of hospitalization, nursing, drugs, care of the worker's family, etc., are to be worked out later. It is reported that the principle of sickness insurance has been enthusiastically received by the employees' associations so far approached by the committee.

Manitoba

THE amalgamation of the Manitoba Medical Association and the College of Physicians and Surgeons of Manitoba is under consideration. The advantage of such an amalgamation is that it would remove the present duplication and overlapping of the business activities of the two organizations, uniting the social, educational and scientific interests of the medical profession of Manitoba.

Dr. C. R. Donovan, D.P.H., is now medical inspector in the Division of Hospitalization which was formed recently with Dr. E. W. Montgomery as chairman.

Ontario

A PROVISIONAL final report contemplating a comprehensive but inexpensive scheme for extension of prenatal, natal and postnatal care to mothers in their homes and at a number of the Department's own clinics, has been approved by the Toronto De-

partment of Public Health's advisory committee on maternal welfare. The committee's programme includes welfare work and medical attention for mothers, both in their homes and at the Departmental clinics with the Department's supervision of doctors specially retained or co-operating in the work. Plans have also been drawn up for the education of doctors, mothers and the public generally in maternal welfare work; for the establishment of recognized standards for prenatal and postnatal care, and for the treatment of special ailments; and for a system of nursing and social services paralleling the medical and clinical programme. Practically all the work which the committee hopes eventually to see carried out in homes and the Department's clinics is now being done in hospitals, and the adoption of the scheme will relieve the city hospitals and clinics of some of the demands for such care.

New Brunswick

SPLENDID progress is being made by the local committee in charge of the arrangements for the 22nd annual meeting of the Association which is being held in Saint John during the week of June 19th. The Canadian Medical Association will also convene in Saint John during the same week and several joint meetings are being planned.

DANIEL ALEXANDER McCLENAHAN

DANIEL ALEXANDER McCLENAHAN, M.D., D.P.H., District Officer of Health for District No. 3 in Ontario, died suddenly at his residence in Hamilton on March 4th.

Dr. McClenahan was born of Scotch-Irish stock at Tansley, Nelson Township, Halton County, Ontario, in 1866. He received his early education at Nelson public school and the Waterdown high school. Like many other successful medical men, Dr. McClenahan began his professional life as a public school teacher in his native county. He attended Trinity Medical College and was graduated from the University of Toronto in 1894. From that date he engaged in medical practice in Waterdown until 1912, when he was appointed District Health Officer. During his residence in Waterdown Dr. McClenahan identified himself with the public activities of the town, being successively a member of the Board of Education and the town council, and on several occasions reeve of the municipality. For a term he was president of the Wentworth County Conservative Association. During the entire period of the war Dr. McClenahan served with the Canadian Army Medical Corps, with the rank of captain. In 1920 he received the Diploma in Public Health from the University of Toronto after undertaking the course in public health at the School of Hygiene.

Dr. McClenahan is known to the present generation chiefly as a public health officer. He possessed to an unusual degree the attributes essential to the success of such an officer: first-class professional training, good personality, tact, cheerful temper, energy and enthusiasm. A physician with eighteen years' experience in urban and rural practice of medicine and with special public health training, he had the advantage of a fine personality and was universally popular. Evidence of his good work is to be seen in the advanced public health position of his district. By the local officers of the nine counties under his supervision he was regarded as a wise counsellor and trustworthy friend.

Dr. McClenahan is survived by his widow and two sons, Harold, at home, and Major R. Roy McClenahan, M.D., D.P.H., formerly, until his extended illness, head of the Preventable Diseases Division of the Provincial Department of Health. To these members of his family the Association tenders its deep sympathy.

BOOKS AND REPORTS

Behaviour Aspects of Child Conduct. *By Esther Loring Richards, B.A., M.D., D.Sc., Associate Professor of Psychiatry, Johns Hopkins School of Medicine; Physician-in-Charge of Dispensary, Henry Phipps Psychiatric Clinic, Johns Hopkins Hospital. With a foreword by Dr. Adolf Meyer. Published by the Macmillan Company, New York,* 1932. 299 *pages. Price,* $3.00.

In her introduction Dr. Richards states:

"One must frankly admit that from the behaviouristic side of science we are confronted with a bewildering mass of words and theories tending to proclaim some particular field of psychology or psychiatry as the one and only method of human salvation."

The physician, school nurse and teacher who have become lost in the maze will welcome this new volume, written by a highly competent psychiatrist and presenting the subject with a keen appreciation of what is theory and what is fact. Some of the chapter headings are *The Role of Behaviour in the Field of Individual Health, Common Principles of Inquiry into Children's Failure to Adjust Themselves Comfortably to Environment, The Importance of Habit Training During Early Years, Facts and Fallacies About Fears of Childhood,* and *Principles in the Management of Adolescence.*

Dr. Richard's book can be heartily recommended as a real guide.

R.D.D.

Human Sterilization. *By J. H. Landman, Ph.D., J.D., J.S.D. Published by The Macmillan Company, New York,* 1932. 341 *pages. Price,* $4.00.

This book is an excellent review of the subject, with an outline at the beginning which is precise and useful. It deals with many sources of material and no drastic conclusions are drawn, giving the reader an accurate picture of the situation rather than the writer's viewpoint.

Part I deals with the eugenics movement, statistics of the mentally incompetent people in the United States, and the history of human sterilization in the United States.

Part II emphasizes the legal aspect of human sterilization. Part III deals with the biology of the problem and amplifies the heredity side of mental deficiency. Part IV enumerates the various surgical operations for human sterilization and their effects. Part V outlines the application of human sterilization from a social viewpoint, and also deals with problems of human sterilization laws.

The author very aptly points out the difference between the alarmist and the optimistic eugenicists.

L.N.S.

Asthma, Hay Fever and Related Disorders. *By Samuel M. Feinberg, M.D., F.A.C.P., Assistant Professor of Medicine, Northwestern University Medical School, Chicago. Published by Lea and Febiger, Washington Square, Philadelphia,* 1933. 124 *pages. Price,* $1.50.

"To the many sufferers—to enable them to co-operate with their physicians who are striving to help them—this book is dedicated."

This little book of 119 pages achieves its purpose. To be of real value, such a book must be scientifically correct, simple in its presentation and interesting to the reader. The following chapter headings are sufficient to give an idea of the scope: *Symptoms of Asthma, Causes, Primary Causes, The Physician's Investigation, The Physician's Treatment, Hay Fever,* and *Other Allergic Disorders.*

R.D.D.

Procedures in Tuberculosis Control for the Dispensary, Home and Sanatorium. *By Benjamin Goldberg, M.D., F.A.C.P., Associate Professor of Medicine, University of Illinois. Published by The F. A. Davis Co., Philadelphia,* 1933. 373 *pages. Price,* $4.00.

The various aspects of the whole

tuberculosis problem as met with in the United States, in contrast to Europe, are well and interestingly outlined.

The facts and the reasons for "enabling" and "enforcement" legislation are clearly outlined. Open cases and contacts are, we feel, not given sufficient attention, considering the trend of opinion to-day. Dispensary and associated activities, chapters VI to X, are given in considerable detail, and similar aspects are discussed under social service, chapters XIV to XVI. Laboratory procedure and surveys are dealt with on pages 112-121. Home treatment is well and clearly outlined.

The third section deals with the sanatorium and it is here that the newer aspects are presented. This is concisely put as follows: "The present day sanatorium, called upon as it should be to meet the new therapeutic indications, surgical and otherwise, in tuberculosis must, if it is to meet those indications adequately, be organized on practically the same basis as a properly managed general hospital." There is, in the opinion of the reviewer, no question as to the significance of this. Any government or voluntary organization contemplating plans for further development of sanatorium beds should be acquainted with the general principles outlined.

The book has a good bibliography and index. It is thoroughly recommended. A.H.W.C.

Final Report on the Massachusetts-Halifax Health Commission (1919-1929). *Published in Halifax, 1932. 72 pages.*

This Commission, formed through the generosity of the citizens of the State of Massachusetts as a direct result of the explosion in Halifax on December 6, 1917, carried on health work in Nova Scotia from October, 1919, to October, 1929. During that time much useful health work was done. From time to time papers and pamphlets were published on what was being accomplished. This report is the final one and gives a succinct but comprehensive account of the activities of the Commission, as well as its approximate results. The illustrations and graphs are excellent.

R.R. McC.

Food in Health and Disease. *By Katherine Mitchell Thoma, B.A., Director of Dietetics, Michael Reese Hospital, Chicago. Published by F. A. Davis Company, Philadelphia,* 1933. 370 *pages. Price,* $2.75.

This book is based on the experience of the author in teaching dietetics to student nurses and is intended for such a purpose. The material is presented in three sections, the first dealing with theoretical considerations, the second discussing diet in disease, and the third outlining practical work. The second section is given a major share of the space. Quite properly, the treatment of the first section is elementary but is essentially accurate. There are a few minor points to which exception might be taken. On page 22, proteins are said to be composed of the elements carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur and iron. On page 77 there is a statement regarding irradiated cod liver oil. Probably the author meant solutions of irradiated ergosterol. On page 92 it is said that one gram of protein burned in a bomb calorimeter yields 4.3 calories. The figure generally given is 5.65. The tables given on pages 98-103 are most commendable and give information regarding mineral content of foods expressed in a form which is not usually available.

The second section of the book is presented in considerable detail and should be most useful to nurses and hospital dietitians. The discussion of the diet in pernicious anaemia, however, is hardly satisfactory and in the discussion of insulin the definition of the unit of insulin is incorrectly stated.

The practical section of the book is intended for training nurses and should be excellent for that purpose. The absence of any illustrations is to

be regretted. On the whole, the book is very satisfactory and should be most useful. E.W. McH.

Nursing in Nervous Diseases. *By James W. McConnell, M.D. Published by the F. A. Davis Company, 1914-16 Cherry Street, Philadelphia,* 1932. 153 *pages. Price,* $1.50.

This small book is admirable as a text-book on nursing care in nervous diseases. The first chapter gives a short, clear account of the anatomy of the brain and the spinal cord. Another chapter deals concisely with such physical therapeutics as hydrotherapy, heliotherapy, exercise, massage and electricity. Other chapters discuss nursing care in such diseases as apoplexy, epilepsy, diseases of the spinal cord, tabes dorsalis, poliomyelitis, neuritis, paralysis agitous, chorea, and neuroses and psychoses.

The book is well written in an interesting and informative manner. Nurses will find it a useful volume. R.R. McC.

Streptococci in Relation to Man in Health and Disease. *By Anna Williams, M.D., Bureau of Laboratories, Department of Health, City of New York. With an introduction by Wm. H. Park, M.D. Published by the Williams & Wilkins Company, Baltimore,* 1932. 260 *pages. Price,* $5.00.

The object of this book, stated in the introduction, is to present "in concise form . . . . a general statement of the important facts and surmises connected with streptococci in health and disease." This is admittedly a difficult task. The many years of study which the author has devoted to this particular field qualify her especially for undertaking it.

Following a brief historical review, the general characteristics of streptococci are discussed in some detail and the incidence of streptococci described. The main experimental investigations are tersely presented, the gaps in the evidence pointed out, and personal observations refuting or confirming the statements of others are added here and there.

Although the reader is frequently referred to other parts of the book, one feels that the division into separate chapters on erysipelas, scarlet fever and septic sore throat has resulted in a certain amount of overlapping, particularly in the sections on exotoxin and agglutinin absorption. These chapters are of considerable interest because of the conflicting views held at present by various investigators as to the specificity of the strains isolated from the diseases in question.

The chapter on septic sore throat contains an instructive summary of eighty-three reports of milk-borne outbreaks of streptococcal infection.

Respecting the haemolytic group of streptococci, emphasis is laid on the complexity of the toxigenic and antigenic relationship of the various strains, the importance of the virulence or invasive power of a strain as distinct from its ability to produce toxin, and hence the necessity for antisera which protect against invasion as well as neutralising toxin, and finally the impossibility of differentiating strains isolated from various types of disease by the present methods.

As to the relationship of streptococci to rheumatic fever, chronic arthritis, and such diseases as measles, influenza and poliomyelitis, the evidence is regarded at present as insufficient to warrant any conclusions. The bibliography comprises six or seven hundred articles, mainly in English.

The text is marred by typographical errors, numerous mistakes in spelling, and occasional innovations such as "exiters," "diffusioning" and "discussants." F.H.F.

CURRENT HEALTH LITERATURE

These brief abstracts are intended to direct attention to some articles in various journals which have been published during the preceding month. The Secretary of the Editorial Board is pleased to mail any of the journals referred to so that the abstracted article may be read in its entirety. No charge is made for this service. Prompt return (after three days) is requested in order that the journals may be available to other readers.

Effectiveness of Child Health Programs in Ontario by Survey Methods

The annual reports of certain municipalities organized for work in the field of child hygiene present statistical incongruities. An endeavour has therefore been made to assay the service in certain representative communities and the records of work performed have been intimately examined and the objectives noted. From this survey the author concludes that few actually engaged in the field of child hygiene are alive to the need for accurate and adequate recording, and that in many instances the purposes of the service are vague or have never been appreciated. A number of observations, statistically supported, are appended for review by those actually responsible for the services. These include the following:— There is no satisfactory health programme in operation for the pre-school age group. It was not demonstrable that the school health staff materially aided in the control of communicable disease. The percentage of defects corrected is lower than it should be. Abnormalities of the tonsil predominate among the major defects. The problem of providing the maximum of pre-natal and post-natal care for pregnant women is far from solution. Prematurity is an outstanding factor in the high infant death rate in the first month.

John T. Phair, Am. J. Pub. Health, *23*: 1 (Jan.), 1933.

Seasonal Variation of Average Growth in Weight of Elementary School Children

The weights of approximately 2,500 white children were recorded monthly during a five-year period and the data analysed. Maximum growth rates were observed during the fall months and minimum rates during the spring. The same cyclic changes occur in both sexes and in each year group from six to fourteen years. These findings agree with previous work on the subject. The maximum growth rate for girls occurs in the eleventh and twelfth years, while for boys it occurs in the fourteenth and fifteenth years. Comparison of the monthly growth rates of a selected group not absent from school for an entire year with the remainder of the group who were absent on account of sickness shows that the typical seasonal variation is not the result of including in the data records of ill children who fail to gain or who lose weight.

Carroll E. Palmer, U.S. Pub. Health Rep., *48*: 211 (Mar. 3), 1933.

Employment of Minors in Hazardous Occupations

Urgent need for more adequate protection of young workers against industrial accidents and occupational diseases is stressed in the report of an advisory committee appointed last year by the Children's Bureau of the United States Department of Labor to study the employment of minors in hazardous occupations. The committee gave consideration only to occupations involving accident or health hazards, and the report makes specific recommendations for the prohibition of employment of minors under 18 years of age in occupations involving mechanical hazards or exposure to injurious substances. The injurious substances specified form a comprehensive list and in addition handling of unsterilized hides or hair and occupations involving exposure to extremes of temperature or excessive humidity are included in the occupations involving health hazards. Reference is also made to the possibility of tenosynovitis and bursitis and measures of control are suggested.

Monthly Labor Rev., U.S. Bureau of Labor Statistics, Dec., 1932.

The Effectiveness of Commercial Diphtheria Toxoid in Active Immunization of Infants

In the course of an immunization programme, a batch of toxoid supplied by one manufacturer gave disappointing results. Several groups of infants were therefore placed on various types of toxoid to determine whether there might be a variation in the antigenic potency in the material marketed. Two series were run on different batches that gave poor results. A very distinct discrepancy was found between these two series and the others immunized with the other toxoids, leading to the conclusion that the material in question was of definitely lower antigenic potency than the other brands.

Joseph Greengard, J.A.M.A., *100*: 793 (Mar. 18), 1933.

Dealing with Syphilis and Gonorrhea as Industrial Problems

The writer discusses the serious direct and indirect losses to industry which result from the prevalence of syphilis and gonorrhea. Appropriate medical examination of employees and the institution of measures of treatment and prevention, including attention to social environment and the encouragement of protective activities by industrial concerns, are recommended.

Walter Clarke, J. Indust. Hyg., *15*: 79 (Mar.), 1933.